Background and Purpose—Stroke is associated with severe economic consequences. This is the first study to investigate in younger survivors the household economic burden of stroke.

Methods—A multicenter, 3-year prospective cohort study was conducted of younger (18–65 years) survivors in Australia. Pre- and poststroke patterns of income and hardship were evaluated and multivariable logistic regression identified the predictors of economic hardship after stroke.

Results—Four hundred fourteen participants were followed up over 12 months after stroke. The variables that independently predicted economic hardship after stroke were: female (OR, 2.94; 95% CI, 1.52–5.70), hazardous alcohol consumption (OR, 2.28; 95% CI, 1.00–5.20), manual occupation (OR, 1.88; 95% CI, 1.07–3.30), lack of health insurance (OR, 2.01; 95% CI, 1.12–3.60), and prior hardship (OR, 3.93; 95% CI, 2.12–7.29), whereas concessional status (OR, 0.50; 95% CI, 0.26–0.95) and more social contacts per week (OR, 0.99; 95% CI, 0.98–1.00) reduced hardship likelihood.

Conclusions—Higher prestroke income did not buffer hardship after stroke nor did clinical, health service, or disability factors. Policies to reduce inequalities after stroke would be best aimed at socioeconomic targets. (Stroke. 2012;43:3110-3113.)

Key Words: Australia ■ economic hardship ■ income ■ younger survivors

Working-aged people constitute approximately 20% of all stroke cases in high-income countries. Among this group, the economic consequences include unemployment, reduction in paid employment, and changes in career for the person and often a family caregiver. There are also unbudgeted out-of-pocket costs associated with medical care, medications, medical equipment, home modifications, transport, and paid care. In most developed countries like Australia, where national health insurance schemes are in place, protection against most out-of-pocket expenses for medical treatment is widely available (see online-only Data Supplement). Nevertheless, protection is rarely complete and there are often significant health-related costs to be managed, compounding the reduction in work capacity and income. Supplementary private health insurance is held by 53.2% (12.2 million) of Australians, but the extent to which it offsets the economic impact of major illnesses such as stroke is not known.

We measured the patterns of income and economic hardship before and after stroke and identified the determinants of economic hardship in younger stroke survivors.
The second outcome measured changes in income after stroke. Equivalized household income, weighting for household composition, was grouped into the following categories: low income (<USD $550), middle income (USD $550 to USD $917), and high income (>USD $917 per week; USD $1 = AUD $1.09, 2010).

### Statistical Analysis
Univariate analyses were used to determine the association between hardship after stroke and various baseline characteristics and multivariate logistic regression was used to identify the predictors of hardship after stroke. Data analyses were conducted using SAS.

### Table. Characteristics of Participants by Hardship Status After Stroke

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (n=414; %)</th>
<th>Yes (n=254; %)</th>
<th>No (n=160; %)</th>
<th>Univariate P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before stroke</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Demographic information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, mean y (±SD)</td>
<td>52.3 (10.1)</td>
<td>52.3 (9.6)</td>
<td>52.5 (10.7)</td>
<td>0.8</td>
</tr>
<tr>
<td>Male</td>
<td>280/414 (68)</td>
<td>165/254 (65)</td>
<td>115/160 (72)</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School certificate or less</td>
<td>151/411 (37)</td>
<td>108/253 (43)</td>
<td>43/158 (27)</td>
<td>0.01</td>
</tr>
<tr>
<td>HSC/trade certificate</td>
<td>111/411 (27)</td>
<td>60/253 (24)</td>
<td>51/158 (32)</td>
<td>0.6</td>
</tr>
<tr>
<td>Diploma/degree or higher (reference)</td>
<td>149/411 (36)</td>
<td>85/253 (34)</td>
<td>64/158 (40)</td>
<td></td>
</tr>
<tr>
<td><strong>Medical history</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>177/413 (43)</td>
<td>122/254 (48)</td>
<td>55/159 (35)</td>
<td>0.007</td>
</tr>
<tr>
<td>Hazardous drinking level (score &gt;8 on AUDIT-C)</td>
<td>65/413 (16)</td>
<td>48/254 (19)</td>
<td>17/159 (11)</td>
<td>0.03</td>
</tr>
<tr>
<td>Previous illness that restricted activity</td>
<td>94/412 (23)</td>
<td>66/254 (26)</td>
<td>28/158 (18)</td>
<td>0.05</td>
</tr>
<tr>
<td>Dependent in ADLs</td>
<td>8/414 (2)</td>
<td>7/254 (3)</td>
<td>1/158 (1)</td>
<td></td>
</tr>
<tr>
<td><strong>Economic circumstances</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time/part-time (reference)</td>
<td>271/414 (65)</td>
<td>158/254 (62)</td>
<td>113/160 (71)</td>
<td></td>
</tr>
<tr>
<td>Retired/unemployed</td>
<td>143/414 (35)</td>
<td>96/254 (38)</td>
<td>47/160 (29)</td>
<td>0.1</td>
</tr>
<tr>
<td>Manual occupation</td>
<td>197/383 (51)</td>
<td>134/235 (57)</td>
<td>63/148 (43)</td>
<td>0.006</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;USD $550 per wk)</td>
<td>74/332 (22)</td>
<td>53/202 (26)</td>
<td>21/130 (16)</td>
<td>0.004</td>
</tr>
<tr>
<td>Middle (USD $550 to USD $917 per wk)</td>
<td>66/332 (20)</td>
<td>49/205 (24)</td>
<td>17/130 (13)</td>
<td>0.002</td>
</tr>
<tr>
<td>High (&gt; USD $917 per wk; reference)</td>
<td>192/332 (58)</td>
<td>100/202 (50)</td>
<td>92/130 (71)</td>
<td></td>
</tr>
<tr>
<td>No private health insurance</td>
<td>220/410 (54)</td>
<td>152/254 (60)</td>
<td>68/156 (44)</td>
<td>0.001</td>
</tr>
<tr>
<td>No income protection insurance</td>
<td>364/410 (89)</td>
<td>234/254 (92)</td>
<td>130/156 (83)</td>
<td>0.007</td>
</tr>
<tr>
<td>Receiving government assistance (concessional status)</td>
<td>130/411 (32)</td>
<td>87/253 (34)</td>
<td>43/158 (27)</td>
<td>0.1</td>
</tr>
<tr>
<td>Economic hardship</td>
<td>150/414 (36)</td>
<td>117/254 (46)</td>
<td>33/160 (21)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Social engagement and contacts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Believes they have the power to make important decisions</td>
<td>325/406 (80)</td>
<td>195/251 (78)</td>
<td>130/155 (84)</td>
<td>0.1</td>
</tr>
<tr>
<td>Believes they need to be alert to potential harm in their neighborhood</td>
<td>127/407 (31)</td>
<td>84/251 (33)</td>
<td>43/156 (28)</td>
<td>0.2</td>
</tr>
<tr>
<td>No. of telephone calls, wk (±SD)</td>
<td>31.1 (28.9)</td>
<td>29.6 (28.5)</td>
<td>33.6 (29.5)</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>After stroke (28 d)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke subtype</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischemic (reference)</td>
<td>345/414 (83)</td>
<td>207/254 (82)</td>
<td>138/160 (86)</td>
<td></td>
</tr>
<tr>
<td>Intracerebral hemorrhage</td>
<td>47/414 (11)</td>
<td>33/254 (13)</td>
<td>14/160 (9)</td>
<td>0.2</td>
</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
<td>4/414 (1)</td>
<td>2/254 (1)</td>
<td>2/160 (1)</td>
<td>0.7</td>
</tr>
<tr>
<td>Unknown</td>
<td>13/414 (3)</td>
<td>8/254 (3)</td>
<td>5/160 (3)</td>
<td>0.9</td>
</tr>
<tr>
<td>Missing</td>
<td>5/414 (1)</td>
<td>4/254 (2)</td>
<td>1/160 (1)</td>
<td>0.4</td>
</tr>
<tr>
<td>Dependent in activities of daily living</td>
<td>74/386 (19)</td>
<td>54/241 (22)</td>
<td>20/145 (14)</td>
<td>0.04</td>
</tr>
<tr>
<td>Returned to any paid work</td>
<td>75/268 (28)</td>
<td>29/157 (18)</td>
<td>46/111 (41)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Accessed rehabilitation</td>
<td>254/414 (61)</td>
<td>162/254 (64)</td>
<td>92/160 (58)</td>
<td>0.2</td>
</tr>
</tbody>
</table>

HSC indicates higher school certificate; AUDIT-C, AUDIT alcohol consumption questionnaire; ADLs, activities of daily living.

*From regression model fit with “hardship after stroke” as the outcome; variables not associated with hardship after stroke (P<0.2) were not significant for inclusion in multivariate models.
Categories are not mutually exclusive.
P-value reported for test of trend of proportions between baseline, 6 and 12 month assessments.

* Australian population estimates are drawn from the Australian Bureau of Statistics 2010 General Social Survey17, a survey of a range of social dimensions, conducted in a representative population sample of adults aged 18 years and older who are usual residents of private dwellings in both urban and rural areas in Australia. Information are only available for a subset of financial stress indicators and dissaving behaviours.

**Figure 1.** Proportion of participants reporting economic hardship and each indicator before stroke and during the 12 months after stroke.

**Results**

The baseline study population included 414 participants (online-only Data Supplement Figure I). The Table shows their 28-day poststroke characteristics and the associations with poststroke hardship.

**Hardship**

Thirty-six percent (n=150) of participants reported hardship before stroke. In the 12 months after stroke, 61% (n=254) of participants had hardship. This reflects a significant increase in the proportion reporting each of the financial stressors and dissaving behaviors, most of which continued to increase significantly by 12 months (Figure 1). The independent predictors of hardship in the 12 months after stroke from the multivariate backward selection regression model (Figure 2) were female sex, hazardous alcohol consumption, manual occupation, lack of health insurance, and hardship before stroke. The factors that decreased the likelihood of hardship after stroke were concessional status (ie, receiving government financial support for living and medical expenses) and the number of social contacts per week. The final model fit
the data well ($\chi^2_{12}=8.48, P=0.39; \text{c}=0.76$). In a sensitivity analysis that only included the participants who had been working before stroke, returning to work by 28 days reduced the likelihood of hardship after stroke (OR, 0.32, 95% CI, 0.16–0.62).

Income
There was a decrease in the proportion of participants in the highest income bracket from baseline to 12 months (59%–44%; online-only Data Supplement Figure II). Among those who reported high income before stroke, 11% ($n=19$) reported low income at 12 months after stroke. Among the middle income earners before stroke, only 35% ($n=21$) remained at this income level at 12 months with 35% ($n=21$) reporting low income. Most of the low-income earners before stroke remained at this income level after stroke (80%, $n=51$).

Discussion
This is the first study designed to measure, in a large consecutively recruited cohort of younger stroke survivors, the economic burden experienced after stroke. Prestroke levels of hardship were significantly greater than the levels typically found in the Australian adult population, suggesting that this cohort had worse economic circumstances to begin with. However, the levels of hardship after stroke in this population increased significantly and are consistent with the estimates reported for other chronically ill patient populations in Australia and internationally. However, actual income per se had no independent buffering effect. Females, manual laborers, and heavy drinkers, all potential surrogates for lower socioeconomic status, faced a greater risk of poor economic outcomes after stroke. This association is only partly due to poorer economic circumstances before stroke in these groups being exacerbated in the aftermath of stroke, because the effect was independent of income. This has important implications for adherence to rehabilitation and medical care, because previous studies indicate that adherence suffers when patients experience financial problems.

We identified policy supports within an Australian context that buffer stroke survivors from hardship. Concessional status before stroke reduced the likelihood of hardship after stroke by 50%. Timely access to these support programs immediately after stroke. This might involve temporary safety net mechanisms or more rapid access to income support programs immediately after stroke. Finally, participants without private health insurance coverage were twice as likely to have hardship after stroke. The support offered by private health insurance may help to offset the medical expenses associated with rehabilitation. However, the higher risk of hardship for the uninsured may also reflect private health insurance status being a marker of higher socioeconomic status in this population.

Conclusions
Economic hardship is common in younger stroke survivors, with two thirds reporting hardship in the 12 months after stroke despite Social Security and national health insurance systems in Australia that are generally considered universal. These findings can help inform strategies to identify survivors who are most at risk of hardship soon after diagnosis to link them into targeted support programs early.

Sources of Funding
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Disclosures
None.

References
How Are Household Economic Circumstances Affected After a Stroke? The Psychosocial Outcomes In StrokE (POISE) Study
Beverley M. Essue, Maree L. Hackett, Qiang Li, Nick Glozier, Richard Lindley and Stephen Jan

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SUPPLEMENTAL MATERIAL

How are household economic circumstances affected after a stroke? The Psychosocial Outcomes In StrokE (POISE) study.

Beverley M Essue MPH, Maree L Hackett PhD, Qiang Li MBiostat, Nick Glozier PhD, Richard Lindley MD and Stephen Jan PhD.
Supplemental Background:

Snapshot of the Australian health and social welfare systems

The Australian government operates a national health insurance scheme known as Medicare, which subsidises non-public outpatient medical treatment and medications. Medicare rebates a portion of the costs of medical, nursing and allied health services on a fee-for-service basis. Some medical services can be bulk-billed, meaning that the provider charges the same amount as the Medicare rebate, resulting in no out-of-pocket expense for individuals. Many prescription pharmaceuticals are also subsidised by the Australian government and individuals are also responsible for contributing a co-payment. The Australian government administers safety net programs to cap individual out-of-pocket costs for medical services and prescription pharmaceuticals. In addition, the State and Territory governments operate a public hospital system, which provides inpatient services free of charge. They also provide some support for treatment and management aids and services (e.g. transport and appliances) and this is usually means tested.

Private health insurance is available for supplementary services such as private hospital treatment, dental services and allied health services and is heavily supported by government subsidies and tax rebates.

The Australian government also operates a separate national welfare system known as Centrelink. Income support through Centrelink is available for age pensions based on means and asset tests and disability pensions based on functional capacity. Pensioners, also referred to as concessional patients, are entitled to receive a number of concessions and subsidies for
living, medical and pharmaceutical expenses and are more likely to receive bulk-billed services.
Supplemental Methods:

At 28 days, data were collected on demographics and detailed pre-stroke (i.e. previous three months) information on medical history and lifestyle risk factors, including hazardous alcohol consumption\(^1\) and tobacco usage, social engagement and activities\(^2\), work duties and household economic circumstances, including income and concessional status (in receipt of government financial support for living and medical expenses). At 28 days, data was also collected on use of rehabilitation, disability and working status. Follow up assessments at 6 and 12 months after stroke collected information on current work, social, living and financial status, psychological problems, household economics, social engagement and activities, disability and rehabilitation.

Outcomes

The ‘household’ was used as the unit of analysis for all economic data as working adults within a household generally pool income, share resources and employ joint strategies to maintain the household’s economic wellbeing. Economic hardship was measured at each data collection time-point using a series of questions about financial stress (e.g. failure to pay basic living and medical expenses) and dissaving behaviour\(^3\). Hardship was constructed as a dichotomous variable indicated by a reported inability to make any of the listed household payments or the use of dissaving behaviour.

The second outcome measured changes in income patterns after stroke. Equivalised household income, was calculated using the Organisation for Economic Cooperation and Development’s equivalence scales\(^4\). Equivalised income makes adjustments to actual income to enable analysis of the relative wellbeing of households of different size and composition,
giving a higher weight to households with more than one individual\textsuperscript{3}. 
Statistical analysis:

Univariate logistic regression models were used to determine the association between hardship after stroke and the following baseline characteristics: demographics, medical history, household economics, social engagement and activities, stroke sub-type, dependence in activities of daily living, return to work and use of rehabilitation services. Variables associated at the $p<0.2$ level of significance with the outcome in the univariate models were considered for inclusion in the multivariable models. The modelling strategy included building one model with manual selection of covariates and one model with backward elimination of covariates, both used complete participant analysis. The variables for age, sex and hardship before stroke were forced in both models. Effect modification was checked between variables in the models to identify interactions that were significant at the level of $P<0.05$. Variables were retained in the final models if they were significant ($P<0.05$). A backward selection model was selected as it provided the most parsimonious model. The variable for return to work at 28 days was not included because it reduced the sample size to n=268. However, it was assessed in a sensitivity analysis. The Hosmer and Lemeshow goodness-of-fit test and area under the ROC curve were used to determine the best prediction model for these data.
Supplemental Results:

Figure 1: Flow of participants into the study

618 participants screened

178 not consented
- Declined participation (40)
- Insufficient English (31)
- Stroke > 28 days prior (22)
- Too ill or deceased (19)
- Not stroke (19)
- Overseas visitor (11)
- In another study (8)
- Cognitive problems (7)
- Died (6)
- Dysphasia (4)
- Other (11)

440 participants consented

26 participants without baseline information or follow-up visits

414 participants included in final analysis

Reasons:
- Too ill/proxy unwilling (8)
- Misdiagnosis, not stroke (6)
- Withdrawal of consent (6)
- Uncontactable (4)
- Deceased (2)
Figure 2: Proportion of participants in each income category at 6 and 12 months after stroke by baseline income status

*Includes participants with complete income data at baseline and 6 and 12 months after stroke (n=294)
Supplemental References


