Treatment of ischaemic heart disease and stroke in individuals with psychosis under universal healthcare

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Inequities in treatment for ischaemic heart disease and stroke for patients with schizophrenia and other psychoses under universal health care

Stephen Kisely

Yan Wang

Leslie Anne Campbell
ABSTRACT

Background: Most data on the quality of vascular care for psychiatric patients come from countries without universal health care.

Aims: To investigate whether patients admitted for ischaemic heart disease or stroke with a history of schizophrenia or related psychosis receive equitable treatment under universal health care.

Method: A population-based study of administrative data across a Canadian province comparing people with and without psychosis (n=65,039).

Results: Of 49,248 admissions for ischaemic heart disease, 1285 had a history of psychosis. Despite a higher one-year mortality, they were less likely to receive guideline-consistent treatment during or after admission: e.g. coronary artery bypass grafting (OR_{adj}=0.35, 95%CI=0.25-0.48), beta-blockers (OR_{adj}=0.82, 95%CI=0.71-0.95), and statins (OR_{adj}=0.51, 95%CI=0.41-0.63). Of 15,791 admissions for stroke, 594 had a history of psychosis. In spite of higher one-year mortality rates, they were less likely to receive cerebrovascular arteriography (OR_{adj}=0.47, 95%CI=0.24-0.93) or warfarin (OR_{adj}=0.55, 95%CI=0.36-0.85).

Conclusions: People with a history of psychosis do not receive equitable levels of vascular care under universal health care.

Declaration of interest: nil
INTRODUCTION

Although circulatory disease is the major cause of excess death in people with psychiatric disorders,1, 2 most studies indicate they experience inequities in specialist medical care. 3-6 The discrepancy is generally, but not always, greater for severe mental disorders such as schizophrenia depending on the study population.3-7 However, studies have generally been of specific groups in the United States, such as the over-65s, the commercially insured or veterans, and may not apply to jurisdictions where health coverage extends to all residents.3-7 Results from countries such as Canada and Australia may be more generalisable. Population-based studies from both countries have shown that while the risk of mortality is greater for psychiatric patients, they are also less likely to receive revascularisation procedures.2,8,9 Again, the discrepancy is greatest for severe psychiatric disorder such as schizophrenia and other non-affective psychosis. However, these population-based studies were unable to describe the experience of individual patients following admission for circulatory disease, or consider differences in the use of vascular drugs associated with reduced morbidity and mortality, such as ACE inhibitors, beta blockers, or statins. In addition, most work has focused on ischaemic heart disease: there is less information on whether psychiatric patients receive equitable care for other circulatory disease such as stroke. It is already known that socio-economic status affects the quality of stroke care even where differential access to health care is minimised by federal-provincial universal health insurance.10 Our hypothesis was therefore that psychiatric status would also affect rates of specialised procedures, or the prescription of vascular medications, following first admission for either ischaemic heart disease or stroke.

METHOD

This study of admissions to hospital for ischaemic heart disease or stroke compares patients with or without severe mental illness in access to appropriate interventions, including vascular medications, under universal health care. By universal health care, we mean coverage that is
extended to all eligible residents of a jurisdiction. The method of payment varies. In some European countries it is met through insurance, while in others such as Canada and Great Britain, it is funded through general taxation and is free at the point of delivery. In a third group of countries, the cost is met through compulsory insurance, with or without copayment.

We focused on schizophrenia and other non-affective psychoses. For brevity, we will refer to all these disorders as psychosis for the rest of the paper. We studied interventions known to reduce morbidity and mortality. These variables that have been suggested as indicators of quality of vascular care following admission for ischaemic heart disease or stroke in Canada. The Capital District Health Authority Research Ethics Board approved the protocol.

Setting
Nova Scotia is a province on the Atlantic seaboard of Canada with a population of just under one million. Halifax is the major metropolitan centre. Under the Canada Health Act, all Canadian residents are entitled to inpatient or outpatient care that is free at the point of delivery. Patients receive treatment at publicly-funded facilities, or are seen by private specialists or general practitioners in the community who bill the Provincial health plan. There are no private hospital beds. The linked administrative databases of Nova Scotia therefore cover health service use in the public and private sectors across the whole province, including in-patient, outpatient, and community contacts with both specialist and primary care services.

Data sources
We used the following administrative databases from the Population Health Research Unit at Dalhousie University from 1995 to 2001: the Discharge Abstract Database for admission type and diagnosis; physician billings for specialists and family physicians including service date
and diagnosis; the Mental Health Outpatient Information System for demographics, diagnoses and mental health clinician visits; and the Seniors’ Pharmacare database of claims under the Provincial drug plan for all patients over 65 years old, including dose and duration. We linked data by using the provincial health card number as a unique identifier. Health card numbers were present in more than 99% of the records, irrespective of the database, and were encrypted to ensure confidentiality.9

Health Canada and the Public Health Agency of Canada have both used administrative datasets for chronic disease surveillance.15,16 Although these data were collected for billing, rather than surveillance, studies using these datasets for disease surveillance have shown acceptable accuracy over time, and against other measures.15-17 The Capital District Health Authority Research Ethics Board approved the protocol.

**Subjects and methods**

This was a retrospective cohort study. We assembled patients who had an initial admission for each condition of interest during the study period. We used the following ICD-9 diagnoses or ICD-10 equivalents: ischaemic heart disease (IHD) (410-414) and stroke (431-438). Two separate analyses were conducted for patients admitted with IHD and for those admitted with stroke. We then compared rates of 28-day and 1-year case fatality, specialised procedures (up to one year post-admission), and the prescription of morbidity and mortality reducing vascular medications within 90 days of discharge among patients who had psychosis with the other subjects.

We derived our sample of individuals with psychosis in the following way. We initially used the case definition of the Public Health Agency of Canada for surveillance of treated...
psychiatric disorders. An individual was considered a case if he/she had at least one visit recorded in the physician billings or MHOIS database, or a discharge from any hospital within one year of their initial admission for circulatory disease, with a diagnosis in the most responsible diagnosis field of the following ICD codes: ICD-9 from 290 through 319 inclusive, or their ICD-10 or DSM-IV equivalents. We included all patients in contact with psychiatric services within the 12 months preceding their initial admission for circulatory disease. We then compared patients with schizophrenia and other non-affective psychoses (295, 297, 298) with the rest of the sample, including the other psychiatric disorders. We will describe schizophrenia and other non-affective psychoses as ‘psychosis’ for the rest of the paper. The comparison psychiatric disorders included dementia and other organic conditions (290-294), alcohol/drug disorders (303-305), and all other psychiatric disorders including mood disorders, neuroses, personality disorders and adjustment reactions (296, 300-302, 306-319). We also conducted sensitivity analyses of the effect of comparing patients with psychosis with the non-psychiatric group only.

For patients admitted with IHD we identified right and left heart catheterisation (ICD-9-CM 37.21-37.23), percutaneous transluminal coronary angioplasty (PTCA) with or without stent (ICD-9-CM 36.01, 36.02, 36.05, 36.06), and coronary artery bypass grafting (CABG) (ICD-9-CM 36.1-36.9). For patients over 65 years old, we identified prescriptions filled within 90 days of discharge from hospital for the following medications known to reduce morbidity or mortality in randomised controlled trials: beta-blockers, ACE inhibitors, statins, angiotensin receptor blockers (ARBs), and clopidogrel. These medications are therefore seen in Canada as indicators of the quality of vascular care. For patients admitted with stroke, we identified two procedures: cerebrovascular arteriography (ICD-9-CM 88.41) and carotid endarterectomy (ICD-9-CM 38.12), and, for the over-65s, prescriptions for clopidogrel,
ticlopidine and warfarin filled within 90 days of discharge. As before, we compared these patients with psychosis to the rest of the sample, including the other psychiatric disorders, as well as conducting sensitivity analyses of the effect of comparing patients with psychosis to the non-psychiatric group only.

Rates of procedures and prescription drug use in the psychotic and non-psychotic groups were examined for up to 1 year after the index cardiological or stroke admission. Significance was tested using odds ratios and 95% confidence intervals. We then used logistic regression to examine the effect of psychosis on each outcome (death, specialist procedure or vascular medication) while adjusting for potential confounders. We included psychiatric diagnosis, age, sex, socio-economic status, comorbidity, and place of residence (in distance in kilometres from metropolitan Halifax). Income levels of the study population were classified into the quartiles of the 1996 Census average household income for the Nova Scotia population by the postal code at the time of initial contact. The presence of medical comorbidity was assessed using the modified Charlson-Deyo index score. This gives a weighted summary score based on 1-year mortality risk.

RESULTS

*Ischaemic heart disease*

49,248 Nova Scotians were admitted with ischaemic heart disease. Their mean age was 65.4 (SD=13.6) and 57.6% (n=28347) were male. Of these, 11,139 had previous contact with primary or secondary care for psychiatric problems. 1285 patients had a history of psychosis. The overall 28-day and 1-year mortality rates were 8 and 12% respectively. Rates at one year for cardiac catheterisation were higher (20%) than those for PTCAs (7%) and CABGs (9%) reflecting the fact that cardiac catheterisation is typically the first step in a decision to offer PTCA or CABG.
Table 1 compares patients with psychosis with the remaining patients. Patients with psychosis had significantly higher 28-day and one-year mortality rates than the rest of the sample, but lower rates of all three specialised procedures (Table 1). We found similar results when we compared psychosis with the non-psychiatric group only.

Of other variables that might be possibly associated with the outcomes of interest, older or female patients and those with comorbidity had increased mortality rates but a reduced chance of receiving specialised procedures (Table 2). By contrast, more affluent patients had a reduced mortality risk but a greater chance of receiving specialised procedures (Table 2). Remoteness as determined by distance to Halifax where specialised services are concentrated, was associated with a reduced chance of receiving specialised procedures (Table 2).

We included all the above variables into our logistic regression model (i.e. psychiatric diagnosis, age, sex, socio-economic status, comorbidity, and place of residence). On multivariate analysis, patients with psychosis had significantly higher one-year mortality rates than the rest of the cohort, and lower rates of all three specialised procedures even after adjusting for the other variables (Table 1). On sensitivity analysis, we found similar results when we compared psychosis with the non-psychiatric group only. One-year mortality was increased (OR$_{adj}=1.30$, 95%CI=1.11-1.51), while there were lower rates of cardiac catheterisation (OR$_{adj}=0.45$, 95%CI=0.37-0.55), PTCAs (OR$_{adj}=0.38$, 95%CI=0.27-0.55) and CABGs (OR$_{adj}=0.32$, 95%CI=0.23-0.45).

Data from Pharmacare were available on the 27629 patients who were over 65 years old. Rates of use ranged from 5 to 38%. Patients with psychosis (n=893) were significantly less
likely to be prescribed beta blockers and statins compared with the general population and other psychiatric diagnoses (Table 1). Older patients, and those with comorbidity, were also less likely to receive vascular medications (Table 2). The results for psychosis remained significant on multivariate analysis (Table 1). Restricting the comparison group to the non-psychiatric patients produced similar results with reduced chances of being prescribed beta blockers (OR_{adj}=0.79, 95%CI=0.68-0.92) and statins (OR_{adj}=0.48, 95%CI=0.39-0.60).

**Stroke**

15,791 Nova Scotians were admitted with stroke. Their mean age was 70.4 (SD=13.1) and 51.1% (n=8071) were male. Of these, 3,632 had previous contact with primary or secondary care for psychiatric problems. 594 patients had a history of psychosis. The overall 28-day and 1-year mortality rates were 4.6% and 10% respectively (Table 3). Six per cent of the sample received one or other of the procedures.

Patients with psychosis had significantly higher one-year mortality rates than the rest of the cohort but lower rates of both specialised procedures (cerebrovascular arteriography and carotid endarterectomy) (Table 3). We found similar results when we compared psychosis with the non-psychiatric group only. As with ischaemic heart disease, female and older patients had increased mortality rates but a reduced chance of receiving specialised procedures (Table 4). There was a less clear pattern for the other variables (Table 4).

On multivariate analysis, patients with psychosis still had significantly higher one-year mortality rates than the rest of the cohort but lower rates of cerebrovascular arteriography even after adjusting for the other variables (Table 3). On sensitivity analysis, comparing psychosis to the non-psychiatric group without the three other psychiatric groups, one-year mortality was
increased (OR_{adj}=1.52, 95\%CI=1.20-1.93) but the results for the specialised procedures were no longer significant.

Data from Pharmacare were available on the 11423 patients who were over 65 years old. Rates of use ranged from 3 to 8\%. Patients with psychosis (n=442) were significantly less likely to receive warfarin compared with the general population and other psychiatric diagnoses, remaining significant on multivariate analysis (Table 3). Again, older patients were also less likely to receive vascular medications (Table 4). Restricting the comparison group to non-psychiatric patients produced similar results, with reduced chances of being prescribed warfarin (OR_{adj}=0.53, 95\%CI=0.34-0.82).

**DISCUSSION**

*Comparisons with previous studies*

People with histories of psychiatric contact have more than double the mortality of the general population, the major causes being ischaemic heart and cerebrovascular disease rather than suicide.\(^1,2\) Possible explanations include differences in incidence, lifestyle, use of psychotropic medication or inequitable access to appropriate health care. Studies from the United States have highlighted how patients with psychiatric disorders are less likely to receive appropriate secondary care and that, in some cases, these deficits seemed to explain much of the subsequent excess mortality.\(^3,6\) However, studies were restricted to specific groups defined by age, database or health cover.\(^3,7\) In the case of studies of the over-65s, samples were restricted to mental disorders recorded as a secondary diagnosis on admission with ischaemic heart disease and so may be an underestimate given the low reported prevalence of psychiatric morbidity (5.3\%).\(^3,4\) A study of patients covered by the Healthcare Investment Analysts (HCIA) -Sachs Projected Inpatient database was limited by the same
definition of psychiatric morbidity.\textsuperscript{5} Findings for the commercially insured may also be less applicable to patients with severe mental illness as they are less likely to have private insurance.\textsuperscript{1,6} The study where there was the least difference between the treatment experience of patients with psychosis and other patients was of veterans.\textsuperscript{7} This system most resembles the type of care in countries such as Great Britain and Canada. Providers are salaried employees, out of pocket costs for patients low, and coverage or eligibility are not tied to employment. However, this sample is still subject to selection bias in that benefits are linked to past military service, and only those with disability related to military service are eligible for the full range of services. United States results may therefore not be less applicable to jurisdictions with universal health care.

Our results suggest that patients with psychosis experience similar disadvantages under universal health care to those in the United States following admission for circulatory disease.\textsuperscript{3-6} They have the highest mortality but least chance of receiving many specialised interventions or circulatory medications. The results are also consistent with findings from ambulatory and primary care where patients with severe mental illness were less likely to be assessed or treated for hyperlipideamia.\textsuperscript{26-30} Finally, this research extends previous findings for ischaemic heart disease by including stroke, with the finding of similar disparities in the quality of care.

\textit{Study implications}

It is commonly assumed that lifestyle, such as obesity, alcohol or tobacco use, explains the increased mortality of patients with psychosis. However, studies of cancer, where many of the risk factors are the same as for circulatory disease (e.g., cigarettes, alcohol or diet), suggest that lifestyle is unlikely to be the sole explanation.\textsuperscript{31-33} Other patient-based explanations could
include lower compliance with treatment or an inability to give informed consent.\textsuperscript{34} It is also possible that physicians are reluctant to offer some procedures because of the ensuing psychological stress, concerns about capacity or compliance with postoperative care, or the presence of contra-indications such as smoking.\textsuperscript{35} In addition, psychiatric patients may be more at risk of developing complications following medical or surgical interventions,\textsuperscript{36} or to have poorer outcomes post-operatively.\textsuperscript{37}

These explanations are less applicable to the prescription of medications known to reduce subsequent morbidity and mortality. Contra-indications to specialised interventions, such as smoking or problems with informed consent, are less relevant to the prescription of vascular drugs such as ACE inhibitors, beta blockers, or statins. The concern for providers of health care, therefore, is that appropriate treatments are not offered because of the stigma of mental disorders in general medical settings.\textsuperscript{30,39}

The findings from this study are particularly relevant given the increasing rates of metabolic syndrome in patients with psychosis. Patients with schizophrenia are at increased risk of metabolic syndrome disorders at rates of between 1.5 and 5 times that of the general population.\textsuperscript{40,41} In turn, people with metabolic syndrome are two to three times as likely to have a heart attack or stroke as those without.\textsuperscript{40,41} Although primary prevention is the approach of choice,\textsuperscript{41} it is likely that greater numbers of patients with psychosis will experience complications such as ischaemic heart disease and stroke. Ensuring equitable access to interventions that reduce morbidity and mortality for these disorders will be of growing importance. Aside from improved screening and monitoring, better co-ordination between general practitioners, psychiatrists and physicians may address the underuse of interventions of proven benefit. The rigid application of guidelines, such as smoking as a
contra-indication to certain procedures, may also disadvantage patients with psychosis. The
importance of ensuring access to appropriate treatment is underlined by results from the
United States, which suggest that quality of medical care seem to explain a substantial portion
of the excess mortality experienced by patients with schizophrenia.4

Study limitations
There are several limitations to the study. We used routinely collected administrative data that
may be subject to recording bias. Data on access to prescriptions were limited to patients over
the age of 65 years old. We did not have data on marital status, length of time since first
contact with services and educational status, all of which may influence mortality.
Administrative data do not contain indicators of circulatory disease severity, such as level of
consciousness and functional status. Neither were we able to study the effect of lifestyle or
behavioural issues such as alcohol, drug or tobacco use. However, when assessing the risk of
ischaemic heart disease, unmeasured risk factors result in little bias, and the effect is to reduce
differences between groups.42 We were also unable to consider the effect of legal status.
However, two studies from Australia and the United States showed no difference in all-cause
mortality rates between involuntary and voluntary patients.1,43 Overall rates of specialised
procedures and circulatory disease prescription were lower in the Nova Scotian administrative
data than have been reported from elsewhere in Canada or the United States.6,12 One
explanation is the use of different denominators as some studies have focussed on patients in
whom interventions were particularly indicated. We were not able to be as specific in this
study, and so our denominator may have contained patients where a specific intervention or
medication was not indicated. This could have biased our results if these individuals were not
evenly distributed between the psychosis and non-psychotic or non-psychiatric groups given
we could not adjust for these factors in our analysis. On the other hand, it is unlikely to
explain every one of our results. Furthermore, as noted previously, unmeasured risk factors result in little bias and tend to reduce differences between comparison groups.\textsuperscript{42} In addition, we were able to adjust for other important clinical predictors, including age, sex, socioeconomic status and comorbid illness. Finally, we were not able to capture the use of aspirin, only clopidogrel, which will have underestimated the use of this medication class in our sample.

\textbf{Conclusions}

In conclusion, people with a history of psychosis do not receive equitable levels of vascular care under universal health care. These findings may have implications for other countries with universal health care such as the United Kingdom. Further research could help establish the relative contribution of physician or patient-based factors and how these can be addressed. In the case of patients, this could be due to problems of registering with a family physician, difficulties in communication, difficulties in scheduling appointments because of frequent changes of address, or missed appointments. In the case of physicians, service providers should be prepared to accommodate the needs of people with mental illness, as they do those with physical difficulties, to enhance access to medical care.
ACKNOWLEDGEMENTS

This study was supported by a Grant-in-Aid award (2004-05) from the Heart and Stroke Foundation of Nova Scotia. The authors’ work was independent of the funder. The data used in this report were made available by the Population Health Research Unit (PHRU) within Dalhousie University's Department of Community Health and Epidemiology. PHRU is a university-based research and support group conducting systematic research into population health, health services and their inter-relationships. The Province of Nova Scotia supplies PHRU with complete Medicare and Hospital files suitable for research purposes. The Unit also has access to a variety of other data sources including clinical databases and large scale population surveys. Although this research is based on data obtained from the Population Health Research Unit the observations and opinions expressed are those of the authors and do not represent those of PHRU. The Capital District Health Authority Research Ethics Board approved the protocol.

AUTHORS

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Table 1: Ischaemic heart disease and psychosis

<table>
<thead>
<tr>
<th>Mortality &amp; procedures</th>
<th>Psychosis n=1285 (%)</th>
<th>No psychosis n=47963 (%)</th>
<th>OR_{unadj} (95% CI)</th>
<th>OR_{adj} (95% CI) a</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-day mortality</td>
<td>153 (11.9)</td>
<td>3821 (8.0)</td>
<td>1.56 (1.32-1.86)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1-year mortality</td>
<td>243 (18.9)</td>
<td>5664 (11.8)</td>
<td>1.74 (1.51-2.01)</td>
<td>1.27 (1.09-1.48)</td>
<td>0.002</td>
</tr>
<tr>
<td>Cardiac catheterisation</td>
<td>112 (8.7)</td>
<td>9639 (20.1)</td>
<td>0.38 (0.31-0.46)</td>
<td>0.47 (0.38-0.58)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Percutaneous transluminal coronary angioplasty (PTCA)</td>
<td>31 (2.4)</td>
<td>3520 (7.3)</td>
<td>0.31 (0.22-0.46)</td>
<td>0.41(0.29-0.59)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Coronary artery bypass grafting</td>
<td>35 (2.7)</td>
<td>4355 (9.1)</td>
<td>0.28 (0.20-0.39)</td>
<td>0.35 (0.25-0.49)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Medication</strong></td>
<td><strong>n=893 (%)</strong></td>
<td><strong>n=26736 (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>288 (32.3)</td>
<td>10261 (38.4)</td>
<td>0.76 (0.66-0.88)</td>
<td>0.82 (0.71-0.95)</td>
<td>0.01</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>216 (24.2)</td>
<td>7072 (26.5)</td>
<td>0.89 (0.76-1.04)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Statins</td>
<td>102 (11.4)</td>
<td>6063 (22.7)</td>
<td>0.44 (0.36-0.54)</td>
<td>0.51 (0.41-0.63)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Angiotensin receptor blockers (ARBs)</td>
<td>37 (4.1)</td>
<td>1244 (4.7)</td>
<td>0.89 (0.63-1.24)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>28 (3.1)</td>
<td>1336 (5.0)</td>
<td>0.62 (0.42-0.90)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

a. Adjusted for age, sex, socio-economic status, comorbidity, and place of residence
Table 2: Socio-demographic and clinical factors associated with ischaemic heart disease outcomes

<table>
<thead>
<tr>
<th>Mortality and procedures</th>
<th>Patient Gender</th>
<th>Odds Ratio (95% CI)</th>
<th>Odds ratio (95% CI)</th>
<th>Average Household Income Quartile</th>
<th>Patient had a known comorbidity</th>
<th>Distance to Halifax Increase/ km *</th>
</tr>
</thead>
<tbody>
<tr>
<td>M (%)</td>
<td>F (%)</td>
<td>$&lt; 33,775$ (%)</td>
<td>$33,776 - 40,183$ (%)</td>
<td>$40,184 - 49,561$ (%)</td>
<td>$&gt; 49,562$ (%)</td>
<td>No (%)</td>
</tr>
<tr>
<td>N</td>
<td>28347</td>
<td>20901</td>
<td>13472</td>
<td>11822</td>
<td>12017</td>
<td>11937</td>
</tr>
<tr>
<td>28-day mortality</td>
<td>2125 (7.5)</td>
<td>1849 (8.8)</td>
<td>1.20 (1.12-1.28)</td>
<td>1.073 (1.07-1.08)</td>
<td>1.04 (0.95-1.13)</td>
<td>0.98 (0.89-1.07)</td>
</tr>
<tr>
<td>1-year mortality</td>
<td>3134 (11.1)</td>
<td>2773 (13.3)</td>
<td>1.23 (1.16-1.30)</td>
<td>1.079 (1.076-1.081)</td>
<td>0.99 (0.92-1.06)</td>
<td>0.92 (0.85-0.99)</td>
</tr>
<tr>
<td>Cardiac catheterisation</td>
<td>6106 (21.5)</td>
<td>3645 (17.4)</td>
<td>0.77 (0.74-0.80)</td>
<td>0.943 (0.942-0.945)</td>
<td>1.02 (0.95-1.09)</td>
<td>1.17 (1.10-1.24)</td>
</tr>
<tr>
<td>Percutaneous transluminal coronary angioplasty</td>
<td>2523 (8.9)</td>
<td>1028 (4.9)</td>
<td>0.53 (0.49-0.57)</td>
<td>0.951 (0.948-0.953)</td>
<td>1.11 (1.00-1.23)</td>
<td>0.854 (0.71-0.91)</td>
</tr>
<tr>
<td>Coronary artery bypass grafting</td>
<td>3339 (11.8)</td>
<td>1051 (5.0)</td>
<td>0.40 (0.37-0.43)</td>
<td>0.973 (0.971-0.975)</td>
<td>1.01 (0.92-1.10)</td>
<td>1.070 (0.89-1.23)</td>
</tr>
</tbody>
</table>

Medication

<p>| N                       | 13972          | 13657               | 7738              | 6894                           | 6794                        | 6203                           | 10282          | 17347               |
| Beta-blockers           | 4570 (32.7)    | 5979 (43.8)         | 1.60 (1.53-1.64)  | 0.959 (0.956-0.962)           | 0.985 (0.978-0.991)        | 0.95 (0.94-0.95)            | 0.94 (0.92-0.95) | 4903 (47.7)        | 5646 (32.5)       | 0.53 (0.50-0.55)   | 1.00 (1.00-1.00)  |</p>
<table>
<thead>
<tr>
<th></th>
<th>ACE inhibitors</th>
<th>Statins</th>
<th>Angiotensin receptor blockers (ARBs)</th>
<th>Clopidogrel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Doses</strong></td>
<td>3128 (22.4)</td>
<td>2922 (20.9)</td>
<td>449 (3.2)</td>
<td>596 (4.3)</td>
</tr>
<tr>
<td><strong>1.68)</strong></td>
<td>4160 (30.5)</td>
<td>3243 (23.7)</td>
<td>832 (6.1)</td>
<td>768 (5.6)</td>
</tr>
<tr>
<td><strong>0.963)</strong></td>
<td>1.52 (1.44-1.60)</td>
<td>1.18 (1.11-1.25)</td>
<td>1.95 (1.74-2.20)</td>
<td>1.34 (1.20-1.49)</td>
</tr>
<tr>
<td><strong>1.12)</strong></td>
<td>0.978 (0.974-0.982)</td>
<td>0.898 (0.893-0.902)</td>
<td>0.971 (0.963-0.98)</td>
<td>0.958 (0.950-0.966)</td>
</tr>
<tr>
<td><strong>1.09)</strong></td>
<td>2043 (26.4)</td>
<td>1624 (21.0)</td>
<td>357 (4.6)</td>
<td>395 (5.1)</td>
</tr>
<tr>
<td><strong>1.08)</strong></td>
<td>1864 (27.0)</td>
<td>1558 (22.6)</td>
<td>336 (4.9)</td>
<td>359 (5.2)</td>
</tr>
<tr>
<td><strong>0.56)</strong></td>
<td>1.03 (0.96-1.11)</td>
<td>1.10 (1.02-1.19)</td>
<td>1.06 (0.91-1.23)</td>
<td>1.02 (0.88-1.18)</td>
</tr>
<tr>
<td></td>
<td>1796 (26.4)</td>
<td>1535 (22.6)</td>
<td>319 (4.7)</td>
<td>341 (5.0)</td>
</tr>
<tr>
<td></td>
<td>1.00 (0.93-1.08)</td>
<td>1.10 (1.02-1.19)</td>
<td>1.02 (0.87-1.19)</td>
<td>0.98 (0.85-1.14)</td>
</tr>
<tr>
<td></td>
<td>1585 (25.6)</td>
<td>1448 (23.3)</td>
<td>269 (4.3)</td>
<td>269 (4.3)</td>
</tr>
<tr>
<td></td>
<td>0.96 (0.89-1.03)</td>
<td>1.15 (1.06-1.24)</td>
<td>0.94 (0.80-1.10)</td>
<td>0.84 (0.72-0.99)</td>
</tr>
<tr>
<td></td>
<td>2949 (28.7)</td>
<td>3229 (31.4)</td>
<td>660 (6.4)</td>
<td>776 (7.5)</td>
</tr>
<tr>
<td></td>
<td>4339 (25.0)</td>
<td>2936 (16.9)</td>
<td>621 (3.6)</td>
<td>588 (3.4)</td>
</tr>
<tr>
<td></td>
<td>0.83 (0.78-0.88)</td>
<td>0.44 (0.42-0.47)</td>
<td>0.54 (0.48-0.61)</td>
<td>0.43 (0.39-0.48)</td>
</tr>
<tr>
<td></td>
<td>1.000 (1.000-1.001)</td>
<td>1.000 (1.000-1.000)</td>
<td>1.000 (0.999-1.000)</td>
<td>1.001 (1.000-1.001)</td>
</tr>
</tbody>
</table>

* Reported to three decimal places given the narrow 95% confidence interval
Table 3: Stroke and psychosis

<table>
<thead>
<tr>
<th>Mortality &amp; procedures</th>
<th>Psychosis n=594 (%)</th>
<th>No psychosis n=15197 (%)</th>
<th>OR_unadj (95% CI)</th>
<th>OR_adj (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-day mortality</td>
<td>684 (4.5)</td>
<td>37 (6.2)</td>
<td>1.41 (1.00-1.98)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1-year mortality</td>
<td>1523 (10.0)</td>
<td>91 (15.3)</td>
<td>1.62 (1.29-2.04)</td>
<td>1.49 (1.17-1.88)</td>
<td>0.001</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>497 (3.3)</td>
<td>9 (1.5)</td>
<td>0.46 (0.23-0.88)</td>
<td>0.47 (0.24-0.93)</td>
<td>0.03</td>
</tr>
<tr>
<td>arteriography</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td>441 (2.9)</td>
<td>11 (1.9)</td>
<td>0.63 (0.34-1.16)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Medication</td>
<td>n=442</td>
<td>n=10981</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ticlopidine</td>
<td>387 (3.5)</td>
<td>15 (3.4)</td>
<td>0.96 (0.57-1.63)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Warfarin</td>
<td>945 (8.6)</td>
<td>22 (5.0)</td>
<td>0.56 (0.36-0.86)</td>
<td>0.55 (0.36-0.85)</td>
<td>0.01</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>338 (3.1)</td>
<td>11 (2.5)</td>
<td>0.80 (0.44-1.48)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

a. Adjusted for age, sex, socio-economic status, comorbidity, and place of residence
Table 4  Socio-demographic and clinical factors associated with stroke outcomes

<table>
<thead>
<tr>
<th>Mortality and procedures</th>
<th>Patient Gender</th>
<th>Age Increase/ year *</th>
<th>Average Household Income Quartile</th>
<th>D</th>
<th>D</th>
<th>D</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (%)</td>
<td>F (%)</td>
<td>Odds Ratio (95% CI)</td>
<td>$&lt;33,775$ (%)</td>
<td>$33,776 -40,183$ (%)</td>
<td>Odds Ratio (95% CI)</td>
<td>$40,184 -49,561$ (%)</td>
</tr>
<tr>
<td>N</td>
<td>7720</td>
<td>8071</td>
<td></td>
<td>4288</td>
<td>3836</td>
<td>3824</td>
<td>3843</td>
</tr>
<tr>
<td>28-day mortality</td>
<td>318 (4.1)</td>
<td>403 (5.0)</td>
<td>1.22 (1.05-1.42)</td>
<td>1.036 (1.029-1.043)</td>
<td>1.10 (0.90-1.35)</td>
<td>1.01 (0.82-1.24)</td>
<td>163 (4.2)</td>
</tr>
<tr>
<td>1-year mortality</td>
<td>724 (9.4)</td>
<td>890 (11.0)</td>
<td>1.20 (1.08-1.33)</td>
<td>1.051 (1.046-1.056)</td>
<td>1.11 (0.97-1.28)</td>
<td>1.06 (0.91-1.22)</td>
<td>350 (9.1)</td>
</tr>
<tr>
<td>CV arteriography</td>
<td>265 (3.4)</td>
<td>241 (3.0)</td>
<td>0.87 (0.72-1.03)</td>
<td>0.949 (0.943-0.954)</td>
<td>1.19 (0.93-1.54)</td>
<td>1.46 (1.15-1.87)</td>
<td>108 (1.7)</td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td>281 (3.6)</td>
<td>171 (2.1)</td>
<td>0.57 (0.47-0.70)</td>
<td>0.976 (0.969-0.982)</td>
<td>1.30 (1.01-1.68)</td>
<td>1.09 (0.83-1.42)</td>
<td>97 (1.5)</td>
</tr>
<tr>
<td>Medication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warfarin</td>
<td>393 (7.5)</td>
<td>574 (9.3)</td>
<td>1.25 (1.10-1.43)</td>
<td>0.989 (0.980-0.999)</td>
<td>1.21 (1.00-1.45)</td>
<td>1.18 (0.97-1.42)</td>
<td>241 (9.1)</td>
</tr>
<tr>
<td>Ticlopidine</td>
<td>176 (3.4)</td>
<td>226 (3.6)</td>
<td>1.08 (0.89-1.32)</td>
<td>0.985 (0.971-0.999)</td>
<td>0.94 (0.71-1.24)</td>
<td>1.12 (0.85-1.47)</td>
<td>113 (2.5)</td>
</tr>
<tr>
<td>N</td>
<td>5219</td>
<td>6204</td>
<td></td>
<td>3120</td>
<td>2873</td>
<td>2780</td>
<td>2650</td>
</tr>
</tbody>
</table>

Note: CI = Confidence Interval
| Clopidogrel | 131 (2.5) | 218 (3.5) | 1.41 (1.14-1.76) | 0.974 (0.958-0.989) | 99 (3.2) | 80 (2.8) | 0.87 (0.65-1.18) | 87 (3.1) | 0.99 (0.74-1.32) | 83 (3.1) | 0.99 (0.73-1.33) | 83 (1.8) | 266 (3.9) | 2.19 (1.70-2.81) | 0.999 (0.998-1.000) |

* Reported to three decimal places given the narrow 95% confidence interval