

## ORIGINAL ARTICLES

# Prevalence of self-reported stroke in association with ethnic background within a multi-ethnic population in Paramaribo, Suriname: Results from the HeliSur study

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### Abstract

**Background:** Suriname is a middle-income country with a multi-ethnic population. Urbanization and ethnicity may be associated with incidence of cerebrovascular disease, but so far this has not been documented for Suriname. The objective of this study was to examine the prevalence of stroke in the capital of Suriname, and its association with ethnicity. **Methods:** Using the self-reported data from the 'Healthy life in Suriname' (HeliSur) study, we determined the prevalence of stroke in 1,478 subjects. The odds for having suffered from stroke in Javanese, Maroons and Creoles were separately compared to the odds in Hindustani. Odds ratios were adjusted for traditional risk factors including age, sex, diabetes, hypertension, dyslipidemia, and smoking, by use of multiple logistic regression analysis. **Results:** The overall prevalence of stroke in urban Suriname is 3.2% (95% CI 2.3 to 4.0%). Hindustani reported the highest prevalence of stroke (4.1%, 95% CI 2.4 to 5.8%) compared to the Javanese (2.0%, 95% CI 0 to 4.0%), Creoles (3.6%, 95% CI 2.7 to 4.5%) and Maroons (1.8%, 95% CI 0.5 to 3.1%). Adjusted odds ratios showed no significant association between ethnic background and stroke. **Conclusions:** Stroke prevalence is high in urban Suriname, and there seems to be ethnic difference in its prevalence. However, with and without adjustments for traditional risk factors, no significant association between stroke and ethnicity could be shown.

### INTRODUCTION

Stroke is one of the leading causes of death globally.<sup>1</sup> It is expected that the occurrence of stroke will increase in low and middle income countries (LMICs), along with an increase in life expectancy, an increase in sedentary lifestyle and consumption of high energy density food as a consequence of urbanization.<sup>2,3</sup> In Suriname, stroke is the leading cause of death<sup>4,5</sup> and Surinamese in the Netherlands show higher rates for stroke compared to other populations.<sup>6</sup> Suriname is a middle-income country<sup>7</sup> situated in the north-east of South America with a population of around 0.5 million people.<sup>8</sup> The country has

gone through a transition toward urbanization in the last decades.<sup>9</sup> A major part of the population (49%) now lives in the capital Paramaribo.<sup>10</sup> Identifying risk factors may help to reduce stroke. However, the prevalence of stroke and its risk factors in Suriname has not been previously investigated.

Paramaribo has a multi-ethnic population of which the largest groups are from South Asian descent (Hindustani), African descent (Creoles, Maroons) and Javanese descent (Javanese).<sup>10</sup> Stroke affects all ethnic groups<sup>2</sup>, but ethnic differences in prevalence remain, supposedly because of variations in risk factor burden.<sup>2,11</sup>

However, studies showing ethnic differences in stroke prevalence despite taking into account the variation in risk burden, would suggest roles for genetic and other risk factors.<sup>12</sup> It is known that Hindustani show a higher risk for diabetes mellitus and stroke compared to other ethnicities.<sup>13,14</sup> It is proposed that Hindustani may have an underlying state of insulin resistance<sup>14</sup> and are ethnically susceptible to atherosclerosis due to endothelial dysfunction<sup>15</sup>, diabetes mellitus and obesity<sup>16</sup> which all might amplify the risk of stroke in comparison to other ethnic groups.<sup>12,17</sup> The Bureau of Public Health of Suriname documented a high mortality due to stroke in Suriname, with a higher mortality rate due to stroke among Hindustani.<sup>18</sup> However, the overall prevalence of stroke in Paramaribo has not been documented. We hypothesize that the prevalence of stroke is higher among Hindustani in Paramaribo compared to other ethnic groups and that there is a positive association between ethnic background and stroke after controlling for conventional risk factors. Therefore, the aim of the present cross-sectional study was to document the prevalence of stroke in the multi-ethnic population of Paramaribo and its association with ethnic background adjusted for traditional cardiovascular risk factors.

## METHODS

### *Study design and study population*

This secondary study uses part of the data collected from The Healthy life in Suriname (HeliSur) study which was designed to assess cardiovascular health of the multi-ethnic population living in Paramaribo.<sup>19</sup> Non-institutionalized citizens living in Paramaribo, aged between 18 and 70 years old were eligible for inclusion (approximately 168,000 subjects.<sup>10</sup>) This age range was in line with other leading research in this area<sup>20</sup> and seemed appropriate since life expectancy is shorter in some ethnic groups even though total life expectancy is on average 71.6 years in Suriname.<sup>21</sup> By law, Suriname is divided into 10 districts and 62 blocks, which are subdivisions at a district level. Each block is divided into enumeration areas. In cooperation with the General Bureau of Statistics, 18 enumeration areas were randomly selected from 1200 enumeration areas in Paramaribo. A cluster household sampling method was used and trained interviewers were sent out for home visits to include all household members of every house until they had reached 100 subjects for one area. According to Lwanga *et al.*, the minimum necessary representative sample

size was calculated to be 1,092 participants to arrive at a relatively precise estimate of the true prevalence.<sup>19,22</sup>

The interviewers were instructed to begin randomly at a house to collect information. To minimize inclusion bias, interviewers went back to the subject's home for a maximum of three times if they were not at home. Subjects had the opportunity to reject participation to the study or to stop at any moment during data collection.

The medical ethical committee of the Ministry of Health in Suriname approved the study. Data was obtained between April 2013 and August 2013.

### *Outcomes*

The primary outcome measure was the history of stroke. The diagnosis of stroke was determined with a positive response to the question whether the participant was ever diagnosed with having had a stroke by a general practitioner, or medical specialist (neurologist).<sup>23</sup>

### *Ethnicity*

Ethnicity was based on self-identification. Subjects could choose whether they considered themselves to be Hindustani, Creole, Javanese, Maroon, Chinese, Amer-Indian, Caucasian, mixed, other or unknown. People from South Asian origin are referred to as Hindustani.<sup>20,24</sup> People from Indonesian origin were classified as Javanese. Creoles were defined as people from African origin who after the period of slavery remained in the city<sup>20,24</sup>, whereas people from African origin who escaped into the hinterland during the slavery period were referred to as Maroons. There were differences in the living conditions, lifestyle and genetic admixture between these groups.

### *Demographic characteristics and cardiovascular risk factors*

Age, gender and marital status were assessed by interview. For the analyses, age was divided into three groups: 18-30, 31-50 and 51-70 years.<sup>25</sup> Marital status was indicated as: married; couple living together; single; divorced; widow(er).

A history of transient ischemic attack (TIA), diabetes mellitus (DM), high blood pressure (HT), dyslipidemia and smoking were selected as potential confounders for the association between ethnicity and stroke.<sup>26</sup> For each risk factor, except for smoking, the subject was asked if they were ever diagnosed by a general practitioner (or medical specialist) for having the disease. To

assess their smoking habits, subjects could choose between: yes, I smoke; no, I do not smoke right now but I did in the past; No, I have never smoked.

### Statistical analysis

Descriptive analyses were used to describe prevalence of stroke and demographic characteristics. The overall prevalence rate for stroke was adjusted to the WHO standard population (<http://seer.cancer.gov/stdpopulations/world.who.html>). Because of low number of participants (<150) for certain ethnic groups, statistical analyses were performed only for the four largest ethnic groups in the sample, which were Hindustani, Creoles, Maroons and Javanese (N=1478). To correct for disproportional frequency of ethnic groups in the overall population compared to the study population, all cases were weighted for ethnic background.<sup>27</sup> For Hindustani the weighting factor was 0.76, for Creole 1.18, for Maroon 0.72 and for Javanese 1.25. As a consequence, the study group for statistical analysis changed to N=1344.

The missing value analysis option for multiple imputations in SPSS was used to prevent any bias which could have been introduced by incomplete data. In case of incomplete data above 5%, multiple imputations were performed to restore data of subjects as much as possible.<sup>28,29</sup>

Fisher's exact tests were used to determine whether potential risk factors for stroke were associated with both ethnicity and stroke. Subsequently, logistic regression analyses were used to determine the association between ethnic background and stroke. For the categorical predictor ethnicity, Creole, Maroon or Javanese

participants were compared to Hindustani. Hindustani were chosen to be the reference group in this study<sup>2</sup> because of a higher number of participants in this ethnic group.<sup>18</sup> Multiple logistic regression analysis was used to adjust the crude Odds Ratio's (ORs) and their 95% confidence intervals for the bias caused by confounding variables. Confounding variables were identified as variables that changed the regression coefficients of ethnic background with more than 10% when they were included in the regression model. Correlation coefficients between all confounders and ethnicity were determined to prevent multicollinearity in the final regression model. All analyses were conducted using IBM SPSS Statistics software version 21 (IBM SPSS, Inc., Chicago, IL, USA). Results were considered significant when  $p < 0.05$ .

## RESULTS

### Participants

Out of 240,924 people living in Paramaribo, approximately 70% was considered eligible for participation in the study.<sup>10</sup> In total, 1,808 citizens were approached to participate in the study of which eventually 1,786 subjects agreed to participate. The distribution of these participants over the ethnical groups is presented in Table 1. After selecting the four largest ethnic groups, data of 1,478 subjects were included for further statistical analyses (Figure 1). Of the 1,478 participants, 63% were female and 37% were male (Table 2). The mean age for the women was 40.1 (SD 14.0) years and the mean age of the men was 40.8 (SD 14.5) years.

**Table 1: Overview of ethnic groups in the total study population.**

Ethnic groups (n)	Total (n=1786)
Hindustani	544 (30.5 %)
Creole	388 (21.7 %)
Maroon	396 (22.2 %)
Javanese	150 (8.4 %)
Caucasian	4 (0.2 %)
Chinese	2 (0.1 %)
Mixed	266 (14.9 %)
Amer-Indian	26 (1.5 %)
Unknown	10 (0.5 %)

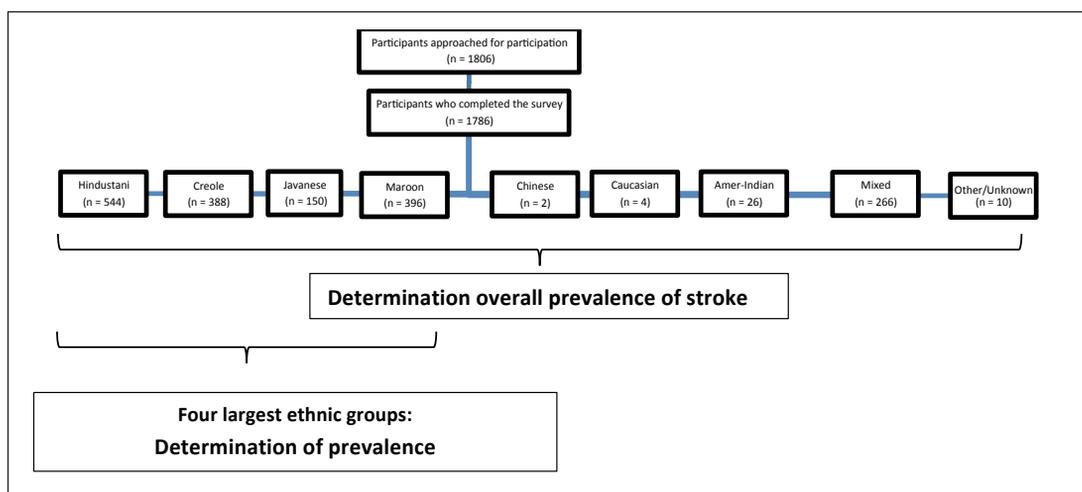


Figure 1. Study flowchart

*Missing value analysis*

Missing value analysis showed that 17% of the data were incomplete. For diabetes mellitus 51% of the data were missing and 32% missing cases were observed for dyslipidaemia. The deletion of

cases decreases the power of the study especially when variable selection is difficult when different variables are missing on different cases. Therefore, multiple (automatic) imputations in SPSS were applied, which is considered the best option for dealing with missing data<sup>30,31</sup> in cardiovascular

**Table 2: Demographic and clinical characteristics of the study population**

	<b>Hindustani (n=544)</b>	<b>Creole (n=388)</b>	<b>Maroon (n=396)</b>	<b>Javanese (n=150)</b>	<b>Total (n=1478)</b>
<b>Gender (n,%)</b>					
Male	226 (41.5%)	151 (38.9%)	121 (30.6%)	54 (36.0%)	552 (37.3%)
Female	318 (58.5%)	237 (61.1%)	275 (69.4%)	96 (64.0%)	926 (62.7%)
<b>Age groups (n,%)</b>					
18-30 years	151 (27.8%)	115 (29.6%)	182 (46.0%)	27 (18.0%)	475 (32.1%)
31-50 years	243 (44.7%)	163 (42.0%)	150 (37.9%)	78 (52.0%)	634 (42.9%)
51-70 years	150 (27.5%)	110 (28.4%)	64 (16.1%)	45 (30.0%)	369 (25.0%)
<b>Marital status (n,%)</b>					
Married/couple	356 (65.4%)	154 (39.7%)	168 (42.4%)	101 (67.3%)	779 (52.7%)
Single	106 (19.5%)	191 (49.2%)	211 (53.3%)	31 (20.7%)	539 (36.5%)
Divorced	39 (7.2%)	26(6.7%)	6 (1.5%)	10 (6.7%)	81 (5.5%)
Widow/widower	34 (7.9%)	9 (1.7%)	6 (2.8%)	6 (5.3%)	55 (5.3%)
<b>Prevalence (n,%)</b>					
Diabetes	131 (24.1%)	51 (13.1%)	46 (11.7%)	26 (17.3%)	254 (17.2%)
High blood pressure	108 (19.9%)	81 (20.9%)	55 (13.9%)	30 (20.0%)	274 (18.5%)
Dyslipidemia	96 (17.6%)	56 (14.4%)	48 (12.1%)	17 (11.3%)	217 (14.7%)
Smoking	164 (30.1%)	149 (38.4%)	62 (15.7%)	54 (36.0%)	429 (29.0%)

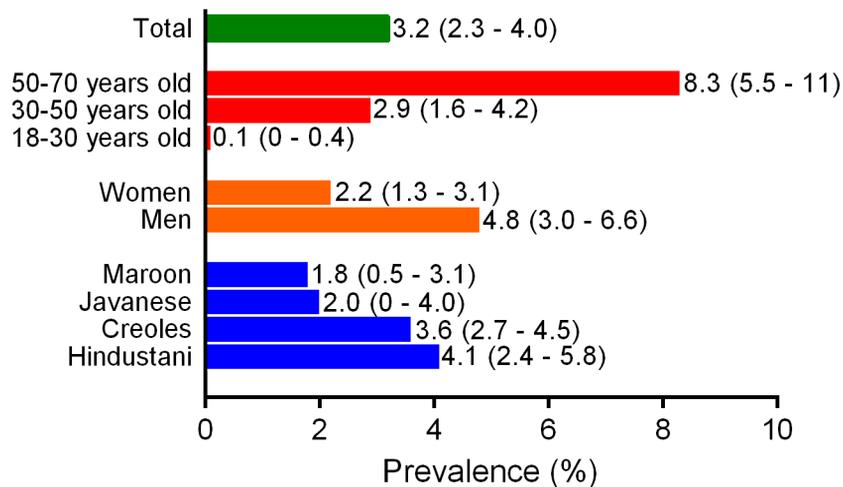


Figure 2. Prevalence of Stroke (%) for 1478 participants including the four largest ethnic groups

health studies. After implying (automatic) multiple imputations on weighted cases, conclusions of the pooled data were presented for the sample of this study.

#### *The prevalence of stroke*

Overall, prevalence of stroke was 3.2%(95% CI 2.3 to 4.0%)(Figure 2). After adjustment to the WHO world standard population, overall stroke prevalence was 2.98%. In the subsample with the four largest ethnic groups, stroke was reported by 46 respondents, which corresponds to a prevalence rate of 3.1% (95% CI 2.2 to 4.0%). Significantly more men than women reported stroke ( $p<0.01$ ) (Figure 2). A statistically significant difference between age groups was found in which the prevalence of stroke was higher for the oldest age group ( $P<0.01$ ) (Figure 2). Hindustani reported the highest prevalence of stroke (4.1%, 95% CI 2.4 to 5.8%) with a difference of more than 0.5% compared to the other ethnic groups (Figure 2).

However, this difference was not statistically significant.

#### *Association between ethnicity and stroke*

Simple logistic regression showed that Hindustani tend to have a higher risk of stroke (Table 3) as compared to Creole, Javanese and Maroon residents. However, none of the crude ORs for stroke were significant (Table 3). Age, diabetes and smoking were considered confounding variables in the association between ethnic background and stroke. The multiple logistic regression analyses showed no significant ORs after adjusting for these confounding variables (Table 3).

#### *The prevalence of traditional cardiovascular risk factors*

The overall prevalence for the traditional cardiovascular risk factors was the highest for

**Table 3: Crude and adjusted odds ratio's (OR) and 95% confidence intervals (CI) for ethnic background in association with stroke adjusted for diabetes, smoking and age groups**

STROKE	Crude OR [95% CI]	Adjusted OR [95% CI]
<b>Ethnicity (N=1478)</b>		
Hindustani	1	1
Creole	0.89 [0.45-1.76]	0.99 [0.48-2.03]
Javanese	0.49 [0.14-1.67]	0.48 [0.14-1.68]
Maroon	0.43 [0.18-1.02]	0.93 [0.38-2.32]

smoking (29.0%), followed by high blood pressure (18.5%), diabetes (17.2%) and dyslipidaemia (14.7%)(Table 2). Hindustani reported more diabetes and dyslipidaemia in comparison to other ethnic groups ( $p < 0.001$  for diabetes,  $p = 0.04$  for dyslipidaemia). Creoles reported the highest numbers for smoking ( $p < 0.001$ ) together with high blood pressure, but the difference between ethnic groups for self-reported high blood pressure was not statistically significant ( $p = 0.092$ ).

## DISCUSSION

This study is the first to document the prevalence of stroke in Paramaribo, overall and by ethnicity. Our study documented an overall prevalence of 3.2% for stroke, however no differences in prevalence were present between the investigated ethnic groups even after adjusting for the confounding effect of risk factors.

### *Overall prevalence of stroke in Paramaribo*

The overall stroke prevalence we now obtained for Suriname is similar to the United States (US) (2.6%)<sup>32</sup>, UK (2.2 – 2.4%) (<http://digital.nhs.uk/catalogue/PUB01170/hea-surv-ethn-min-eng-2004-rep-v1.pdf>), higher compared to prevalence in France (1.6%)<sup>33</sup>, urban Jakarta (0.8%)<sup>34</sup>, Africa (1%)<sup>35</sup>, and Central Spain (0.5%)<sup>36</sup>; but less when compared to Northern England (4.7%)<sup>37</sup>, urban Spain (8.5%)<sup>38</sup>, Hong Kong (5.1%)<sup>39</sup>, and Colombia (5.6%)<sup>40</sup>. Observed differences between studies may be explained by variation in lifestyles and cultures, the presence of cardiovascular risk factors within ethnic groups, urban or rural, and the methods of study.<sup>41</sup> It should be noted that disease prevalence is also the difference between incidence and mortality. Nevertheless, stroke is an important cause of mortality in Suriname (9.4%), which is consistent with the high prevalence of self-reported stroke in this study.<sup>18</sup>

### *Association between ethnicity and stroke*

Hindustani and Creole are known for higher rates of stroke<sup>6,25</sup> and higher rates for stroke risk factors compared to other ethnic groups.<sup>6,11,24</sup> There are multiple explanations for this higher risk for stroke such as presence of genetic differences, differences in socioeconomic factors and living environments. The study by Agyemang<sup>6</sup> compared Hindustani and Creole to Ethnic Dutch people in the Netherlands and found higher rates of hypertension, obesity, diabetes and smoking, but this could not explain the difference in stroke

prevalence they found between Moroccan, and Chinese in comparison to aforementioned ethnic groups. Other studies show genetic predisposition for endothelial dysfunction in Hindustani, which might underlie a predisposition for stroke.<sup>42</sup> To our knowledge, hereditary factors for endothelial dysfunction in Creoles and Javanese have not been studied and stroke heritability in general is still only scarcely been investigated.<sup>43</sup> However, despite our hypothesis and despite the differences in cardiovascular risk factors between ethnic groups, we could not demonstrate an association between ethnicity and stroke. As the pathogenesis of stroke is multifactorial, this study further emphasizes the importance of traditional risk factors even in genetically diverse populations.

### *Preliminary recommendations for preventive strategies*

The high prevalence of stroke reported in this study should be taken into account when preventive strategies are taken.

### *Strengths and limitations of the study*

The limitations in this study are: First, for feasibility reasons, we chose to use self-report to document stroke, which may be less accurate due to recall bias. Nonetheless, self-reports have been shown to be valid and cost-effective.<sup>44-46</sup> It should be noted that under reporting rather than over reporting of stroke is more important in studies based on self-report.<sup>37,47</sup>

Second, socio-economic inequalities are important to consider in ethnic minorities.<sup>48</sup> Such data were not available in this study, but could have affected the association between ethnicity and stroke. Additionally, lack of corroborative information from medical records or clinical assessment; missing data for some risk factors (e.g. diabetes mellitus and dyslipidemia) are further limitations.

Third, our study population was primarily recruited to examine cardiovascular health in Paramaribo.<sup>19</sup> In order to study the association between ethnicity and stroke, there was a necessity for calculation of the statistical power based on ethnic background rather than cardiovascular risk factors. Weighted factors were applied in order to obtain statistical power for our analyses, but true ethnically designed studies are necessary to further investigate the association between genetic/ethnic burden and stroke.

In conclusion, our study shows a substantial prevalence of stroke in urban Suriname. The risk

of stroke tends to be higher among Hindustani as compared to Creole, Maroon and Javanese. However, with and without controlling for traditional cardiovascular risk factors there was no statistical difference in risk for stroke between the ethnic groups. This indicates that identification of other cardiovascular risk factors as well as socio-cultural and socio-economic aspects within this high risk population is warranted, through future studies with larger sample size and more objective assessments.

## DISCLOSURE

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Conflict of interest:None

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