Accuracy of telephone triage in suspected transient ischaemic attack or stroke: A cross-sectional study

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Research article

Keywords: transient ischaemic attack, stroke, telephone triage

Posted Date: May 27th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-27478/v1

Version of Record: A version of this preprint was published on December 5th, 2020. See the published version at https://doi.org/10.1186/s12875-020-01334-3.

Abstract

Background

The Netherlands Triage Standard (NTS) is a widely used decision support tool for telephone triage at Dutch out-of-hours primary care services (OHS-PC), which, however, has never been validated against clinical outcomes. We aimed to determine the accuracy of the NTS urgency allocation for patients with neurological symptoms suggestive of a transient ischaemic attack (TIA) or stroke, with the clinical outcomes TIA, stroke, and other (neurologic) life-threatening events (LTEs) as the reference.

Method

A cross-sectional study of telephone triage recordings of patients with neurological symptoms calling the OHS-PC between 2014 and 2016.The allocated NTS urgencies were derived from the electronic medical records of the OHS-PC. The clinical outcomes were retrieved from the electronic medical records of the patients' own general practitioners. The accuracy of a high NTS urgency allocation (medical help within three hours) was calculated in terms of sensitivity, specificity, positive and negative predictive values (PPV and NPV) with the clinical outcomes TIA/stroke/other LTEs as the reference.

Results

Of 1,269 patients, 635 (50.0%) received the diagnosis TIA/stroke (34.2% TIA/minor stroke, 15.8% major ischaemic or haemorrhagic stroke), and 4.8% other LTEs. For TIA/stroke/other LTEs, the sensitivity and specificity of the NTS urgency allocation were 0.72 (95%CI 0.68–0.75) and 0.48 (95%CI 0.43–0.52), and the PPV and NPV were 0.62 (95%CI 0.60–0.64) and 0.58 (95%CI 0.54–0.62).

Conclusions

The NTS decision support tool used in Dutch OHS-PC performed poor to moderately regarding safety (sensitivity) and efficiency (specificity) in allocating adequate urgencies to patients with and without TIA/stroke/other LTEs.

Trial registration: the Netherlands National Trial Register, identification number NTR7331.

Background

Prompt recognition of patients with a transient ischaemic attack (TIA) or ischaemic stroke is crucial for timely initiation of therapeutic interventions to minimise the risk of (permanent) brain injury and recurrent stroke.(1-6) Previous studies showed that urgent diagnostic assessment of TIA and minor stroke patients followed by a timely start of stroke preventive treatment resulted in a tremendous decrease of the early stroke risk (1, 5, 7) with a reduction of recurrent stroke up to 80% within three months.(1) However, the detection of TIA, and to a lesser extent stroke, may be challenging because multiple other diseases like migraine with aura, seizures or syncope can mimic TIA or stroke.(8-10) Moreover, symptoms may be non-

specific in TIA or stroke, notably vertebrobasilar insufficiency, and in the case of TIA, symptoms are often short lasting and already resolved by the time a patient seeks medical help.(8, 11)

Patients with symptoms suggestive of TIA or stroke often contact the general practitioner (GP) first.(12-15) During evenings, nights and weekends such care is provided by the out-of-hours services in primary care (OHS-PC). At the OHS-PC, the initial contact is by telephone, and nurses perform triage while supervised by GPs.(16) The goal of telephone triage is to assess the severity of patients' complaints and to link this to an adequate urgency allocation with corresponding response time to medical care. Telephone triage in the Netherlands is supported by a semi-automatic decision support tool called the 'Netherlands Triage Standard' (NTS). The NTS is a five-level triage tool, which was developed by an expert panel and derived from existing Dutch national telephone guidelines for primary care office hours, and the Manchester Triage System (MTS).(17, 18) Based on the annual incidence of 0.006% of serious adverse events (SAEs) in the Dutch OHS-PC setting, the NTS is considered to be safe (19). However, questions have been raised about the efficiency.(16) There was a clear increase in high urgency allocations since the implementation of the NTS in 2011 onwards, suggesting a low efficiency.(20) This was supported by the results of a national survey among GPs in 2016, showing that the vast majority believed telephone triage with the NTS resulted in unnecessary consultations and home visits.(16, 21)

Most previous studies assessed the overall accuracy of triage decision support tools in emergency department (ED) settings, and to a lesser extent at the OHS-PC.(22, 23) Few studies focused on specific domains of patients (e.g. chest pain), some of which included clinical outcomes as the reference (e.g. acute coronary syndrome), yet, only in ED settings.(24-31) Comparable accuracy studies in primary care settings are limited; one study that assessed the overall accuracy of a telephone triage tool in primary care used a 'surrogate' reference created by the researchers themselves (e.g. hospital referrals or costs).(18, 22, 32-34) The NTS urgency allocation, or the urgency allocation of other decision support tools for telephone triage in primary care settings, were never evaluated against the final clinical outcomes of patients as the reference.

We aimed to determine the accuracy of the NTS urgency allocation in patients calling the OHS-PC with symptoms suggestive of TIA or stroke, with presence or absence of the final clinical outcomes TIA, stroke and other (neurologic) life-threatening events (LTEs) as the reference.

Methods

Design and setting

We conducted a cross-sectional study in which we analysed real-life telephone triage recordings of nine

OHS-PC locations in the vicinity of Utrecht, the Netherlands between 2014-2016. These OHS-PCs provide out-of-hours primary care for approximately 1,5 million people, handling 400,000 triage calls per year.

Data collection

We evaluated patients with symptoms suggestive of TIA or stroke. The accuracy of NTS urgency allocation was assessed with the final clinical outcomes as the reference, that is, TIA, stroke and other (neurologic) life-threatening events (LTEs), e.g. subarachnoid haemorrhage. The triage recordings were selected in a two-step inclusion procedure, i.e. (i) selection based on the International Classification of Primary Care (ICPC) codes that are linked to the call and reflected our study domain (i.e. K89, K90, N17, N18, N19, N29, N89, N91), and (ii) keywords in the OHS-PC electronic medical records suggesting TIA/stroke (e.g. neurological deficit, arm or leg weakness, face drooping, communication problem, visual problem, sensory disturbances and common synonyms).(35) A detailed description of the ICPC codes, medical keywords, inclusion and exclusion criteria has been published elsewhere.(36) We selected and re-listened a random sample of 2,209 calls. Patient and call characteristics, and assigned NTS urgencies were collected. From the patients' own GPs we retrieved the final diagnosis, which was based on the discharge letter from the neurologist or the ED if the patient was referred for additional investigations. For patients who were not referred to the hospital we used follow-up data from the electronic medical records of GPs for up to one month to capture possible recurrence of TIA/stroke.

NTS urgency allocation in day-to-day practice

Telephone triage with the NTS starts with a mandatory 'ABCD' check (i.e. airway, breathing, circulation, disability). In case of direct life-threatening situations, an ambulance will be sent immediately.(37) If there is no life-threatening situation, the triage nurse continues by choosing one out of the 56 main complaints within the NTS. Every main complaint consists of an algorithm composed of hierarchically ordered questions. (18). One of these 56 main complaints is 'neurological deficit'. After filling out the patient's responses, the NTS will automatically generate an urgency level ranging from U0 to U5 which is linked to the response time within which a patient should receive medical help (see Table 1).(18, 38) The NTS urgency may be scaled up or down by the triage nurse, often after first consulting the supervising GP.(21) The reason for overruling should be registered, but this is not a mandatory step to complete the NTS triage process.

Difference between NTS urgency and final urgency

Besides the NTS urgency, which is automatically generated, we also evaluated the final urgency, which was defined as either the NTS urgency (if not changed) or the overruled NTS urgency.

In around 20% of all triage calls, the final urgency was unclear after re-listening the recordings in which it was evident that the triage nurse overruled the NTS urgency. This because the triage nurse did not notify the actual allocated urgency after overruling the NTS; e.g. the NTS urgency was U3, but in the audio recording the triage nurse tells the caller “I will sent an ambulance immediately” (U1)). Nevertheless, the urgency in the NTS system remained U3. A panel of three experienced GPs assessed calls in which the final urgency was unclear, blinded to the final diagnosis, and determined the final urgency (unanimously, or majority of votes after group discussion).

Data analyses

The patients were dichotomised into a high (U1 and U2) and low (U3, U4 and U5) urgency group, and differences in characteristics between these groups were compared. We calculated the accuracy in terms of sensitivity, specificity, positive and negative predictive values of (i) the NTS urgency allocation and (ii) the final urgency allocation (including overruled NTS urgencies), with the clinical outcomes TIA/stroke/LTEs as the reference. For the accuracy calculations we considered for TIA/minor stroke case the urgencies U1, U2 and U3 as adequate, and for major stroke and other LTEs the urgencies U1 and U2. Finally, we compared the baseline characteristics of patients in whom we could retrieve the final diagnosis with those in whom we could not, to assess potential selection bias. Statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

Results

Group characteristics

We included 1,269 patients of whom a final diagnosis could be obtained (see Figure 1). The median age was 72.0 (IQR 57.0-83.0) years, and 56.9% were female. The NTS allocation of high (U1 and U2) and low (U3, U4 and U5) urgencies was equally distributed between men and women (see Table 2).

The characteristics of patients with a known final diagnosis were comparable with those for whom the GP did not provide the final diagnosis (see Supplementary data Table S1).

Compared to the low NTS urgency group, patients in the high NTS urgency group were older (73.5 vs. 69.0 years, p<0.001). Also, the call duration of patients in the high urgency group was shorter (06:32 min vs. 07:59 min, p<0.001), and more often someone else called on behalf of the patient (80.6% vs. 68.5%, p<0.001) in comparison to the low NTS urgency group. In nearly all calls concern about the symptoms was expressed (90.3% vs 96.1%, p=0.006), and in the vast majority, symptoms were still present at the time of calling (93.4% vs. 89.9%, p=0.030). Patients classified as high urgent more often had face drooping (54.3% vs. 39.1%, p<0.001), arm weakness (51.0% vs. 28.1%, p<0.001), leg weakness (49.0% vs.

35%, p<0.001), and communication problems in general (80.8% vs. 72.5%, p=0.008), whereas patients classified as low urgent more often reported sweating (36.7% vs. 56.3%, p=0.006).

Final diagnoses

In 434 (34.2%) patients the final diagnosis was a TIA or minor stroke, and in 201 (15.8%) a major stroke. Sixty-one (4.8%) patients had other LTEs, i.e. intracerebral haemorrhage or subarachnoid haemorrhage. The remaining 573 patients (45.2%) were diagnosed with other neurological disorders (e.g. migraine, epilepsy) or other disorders (e.g. peripheral vestibular syndromes or psychogenic syndromes). See Table 3 for a complete overview of final diagnoses.

Final urgency allocation

Of all 1,269 patients, 770 (60.7%) received a high NTS urgency (U1 or U2) and 499 (39.3%) a low NTS urgency (U3, U4 or U5). In 728 (57.4%) patients the NTS urgency was equal to the final urgency. In the remaining 541 (42.6%) patients the NTS urgency was overruled, of which in 364 (67.3%) patients the NTS urgency was scaled up by the triage nurse, and in 177 (32.7%) patients it was scaled down (see Figure 2 and for details supplementary data Tables S2-S5).

Accuracy of the NTS urgency and TIA/stroke, or TIA/stroke/other LTEs as the reference

The sensitivity of the NTS for allocating a high urgency to patients with TIA/stroke was 0.71 (95% CI 0.68-0.75), and for patients with TIA/stroke/other LTEs 0.72 (0.68-0.75). The specificity was 0.46 (0.42-0.50) and 0.48 (0.43-0.52), respectively. The positive and negative predictive values were 0.41 (0.38-0.43) and 0.75 (0.72-0.78) for TIA/stroke, and 0.62 (0.60-0.64) and 0.58 (0.54-0.62) for TIA/stroke/other LTEs, respectively.

Accuracy of the final urgency (including overruling) and TIA/stroke, or TIA/stroke/other LTEs as the reference

The sensitivity of the final urgency allocation for allocating a high urgency to patients with TIA/stroke was 0.86 (0.84-0.89), and for TIA/stroke/other LTEs 0.86 (0.83-0.89). The specificity was 0.38 (0.34-0.42) and 0.40 (0.36-0.44), respectively. The positive and negative predictive values for TIA/stroke were 0.42 (0.40-0.44) and 0.84 (0.81-0.87), respectively, and for TIA/stroke/other LTEs 0.63 (0.62-0.65) and 0.70 (0.66-0.74), respectively. See also Table 4.

Discussion

Summary

Of 1,269 patients suspected of TIA/stroke, 635 (50.0%) showed to have a TIA or stroke; 434 (34.2%) had a TIA or minor stroke, 201 (15.8%) a major ischaemic or haemorrhagic stroke. In addition, 61 (4.8%) patients had other (neurologic) LTEs. The urgency allocation of the NTS tool was poor to moderate regarding sensitivity and specificity with TIA/stroke/other LTEs as the reference. In 42.6% the NTS urgency was overruled by the triage nurse. The final urgency allocation (including overruled NTS urgencies) showed modestly improved sensitivity (safety) whereas the specificity remained equally poor (efficiency). The positive predictive value did not change after overruling of the NTS, but the negative predictive value increased. This suggests that overruling by the triage nurses leads to safer telephone triage without compromising efficiency (i.e. overlapping confidence intervals of the NTS and final urgencies' specificities).

Strengths and limitations

This is the first study to report accuracy findings of the NTS tool for telephone triage at the OHS-PC with clinical outcomes as the reference. Because researchers were blinded to the final clinical outcome during data collection, the effect of hindsight bias was limited.

A limitation was missing data on the final clinical outcome (25% of all re-listened recordings). However, a detailed comparison in patient characteristics between those with a final outcome and those without showed that these groups were comparable (no indication of selection bias). Therefore, we believe our results are generalizable to similar OHS-PC settings.

Comparison with existing literature

As described previously, many studies assessed the accuracy of other triage systems (22), and some of these also used clinical outcomes as the reference.(24-31) One study assessed the Manchester Triage System (MTS) in the domain of patients suspected for neurological disease seen at the ED.(32) The accuracy of a high urgency allocation was calculated with neurological disease (not otherwise specified) as the reference; a c-statistic of 0.73 was reported. High MTS urgency allocation was significantly associated with neurological disease (odds ratio 3.0, 95%CI 2.4-3.8, $p<0.001$).(32) Unfortunately, sensitivity or specificity was not calculated. Comparison to our study is also hampered, because in the primary care setting the prevalence of emergent cerebrovascular events is lower, and on average includes less severe cases. This may be reflected in less evident clinical presentations.

In our study, we considered different urgency levels as adequate; for TIA/minor stroke U1-U3, and for major stroke/other LTEs U1-U2. The rationale for high urgency allocations in suspected stroke patients is mainly because of available treatment options, and not because TIA/stroke may result in ABCD instability (i.e. airway, breathing, circulation, disability). Assigning high urgency levels to patients with acute stroke enables early initiation of (invasive) prognostically beneficial treatment.(39-41) In patients with TIA/minor stroke early initiation of antiplatelets for secondary stroke prevention is key, given the substantial risk of major stroke in the first hours to days after a TIA (5, 6, 42). Current treatment guidelines on TIA/stroke recommend that patients suspected of TIA should be seen within 24 hours after symptom onset at a TIA outpatient clinic for a neurological assessment, while secondary stroke prevention should be started as soon as possible after a confirmed diagnosis of TIA/minor stroke (43, 44) or directly if the patient cannot be assessed by a neurologist the same day.(45) Therefore, we considered U3 (patient seen within three hours) as sufficient in patients who finally showed to have had a TIA/minor stroke.

Implications for research and/or practice

Our study indicated that the accuracy of the NTS was poor to moderate, yet safety improved after overruling by the triage nurse. Apparently, triage nurses and/or their GP supervisors capture some vital patient information that is not yet incorporated in the NTS. Further improvement of safety, as well as improving efficiency of telephone triage in the domain of patients calling with neurological symptoms is necessary. Improving the accuracy of already existing triage systems such as the NTS should be the first step. In order to do so, prediction models are needed based on multivariable analyses to provide an evidence-based basis for which triage questions are helpful, and which are not.

Conclusions

The NTS decision support tool used in Dutch OHS-PC performed poor to moderately regarding safety (sensitivity) and efficiency (specificity) in allocating adequate urgencies to patients with and without TIA/stroke/other LTEs. There are indications that overruling the NTS by triage nurses improves safety, without compromising efficiency.

List Of Abbreviations

GP: General Practitioner; LTE: Life-Threatening Events; NTS: Netherlands Triage Standard; OHS-PC: Out-Of-Hours Services in Primary Care; TIA: Transient Ischaemic Attack.

Declarations

Ethics approval and consent to participate

The Medical Ethics Review Committee Utrecht, the Netherlands approved this study (National Trial Register identification number: NTR7331, reference number WAG/mb/16/003208). In addition, a waiver of informed consent was granted as our study involved minimal risk to subjects and this study would not have been practicable without the waiver. All personal and research data were handled and stored according to the European General Data Protection Regulation.

Consent for publication

Not applicable as all personal and research data were made unidentifiable

Availability of data and materials

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by (i) the department of general practice of the University Medical Center Utrecht, (ii) Associate Professorship-promotion grant of D.L. Zwart, MD, PhD, (iii) the foundation ‘Netherlands Triage Standard’ and (iv) the ‘Stoffels-Hornstra’ foundation. The views expressed are those of the authors and not necessarily those of the foundations. This research was conducted without direct involvement from both funding foundations.

Authors' Contributions

DLZ and FHR conceived the idea for the study and gained funding. All authors designed the study. DCE and LTW collected the data, and DCE analysed the data. DCE prepared the manuscript and wrote the first draft, supervised by DLZ. All authors provided intellectual input, critically reviewed the manuscript and read and approved the final manuscript.

Acknowledgements

The authors thank the OHS-PC foundation ‘Primair Huisartsenposten’ and all employees of the participating locations for their cooperation in this study, notably for providing data and technical support.

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Tables

Table 1. NTS levels of urgency

NTS Urgency level	Definition	Response time	Medical help
U0 – Resuscitation	Loss of vital functions	Immediately	Ambulance
U1 – Life threatening	Unstable vital functions	Within 15 minutes	Ambulance
U2 – Emergent	Vital functions in danger or organ damage	As soon as possible, within 1 hour	Home visit by GP or appointment at OHS-PC
U3 – Urgent	Possible risk of damage, human reasons	A few hours (<3 hours)	Home visit by GP or appointment at OHS-PC
U4 – Non-urgent	Marginal risk of damage	24 hours	Appointment at OHS-PC or telephone advice
U5 – Advice	No risk of damage	Advice, no time related	Telephone advice

GP: General Practitioner; NTS: Netherlands Triage Standard; OHS-PC: Out-Of-Hours Services in Primary Care

Table 2. Characteristics of 1,269 patients with symptoms suggestive of TIA or stroke calling the OHS-PC

	High NTS urgency n=770 (60.7%)	Low NTS urgency n=499 (39.3%)	P-value[#]
ent characteristics:			
ian age in years (IQR)	73.5 (59.0-84.0)	69.0 (55.0-82.0)	<0.001
ale sex	441 (57.3)	281 (56.3)	0.736
ly history of CVD (n=36)	14 (82.4)	13 (68.4)	0.451[&]
ical history:			
iovascular disease (n=882)	421 (79.1)	259 (74.0)	0.076
n=637)	116 (29.7)	60 (24.4)	0.147
ke (n=637)	113 (28.9)	60 (24.4)	0.213
nary artery disease (n=303)	36 (20.6)	18 (14.1)	0.144
ythmia (n=292)	32 (19.5)	25 (19.5)	0.997
ular heart disease (n=260)	16 (10.9)	9 (8.0)	0.429
t failure (n=263)	14 (9.5)	10 (8.7)	0.831
psy (n=233)	15 (11.6)	9 (8.7)	0.458
aine (n=102)	17 (27.0)	14 (35.9)	0.342
iovascular risk factors:	14 (9.5)	10 (8.7)	0.831
rtension (n=421)	121 (50.2)	85 (47.2)	0.544
rcholesterolemia or use of statins (n=395)	95 (43.0)	75 (43.1)	0.981
etes mellitus (n=417)	87 (36.7)	63 (35.0)	0.719
iovascular medication:			
hrombotics (n=939)	290 (48.7)	149 (43.4)	0.123
r cardiovascular medication (n=764)	253 (57.55)	178 (54.9)	0.480
characteristics:			
ian call duration in min:sec (IQR)	06:32 (04:43-08:54)	07:59 (05:54-10:50)	<0.001
ian time for caller's introduction in min:sec)	00:19 (00:12-00:27)	00:20 (00:13-00:29)	0.189
l call by someone else than the patient	621 (80.6)	342 (68.5)	<0.001
ge nurse consulted the general practitioner	449 (58.3)	305 (61.1)	0.319
NTS complaint chosen by triage nurse			
ological deficit	587 (76.2)	220 (44.1)	<0.001
ness	21 (2.7)	87 (17.4)	<0.001
lache	23 (3.0)	28 (5.6)	0.020
behavior	21 (2.7)	18 (3.6)	0.375
ope	20 (2.6)	9 (1.8)	0.355
n problem	2 (0.3)	25 (5.0)	<0.001[&]
or arm problem	11 (1.4)	34 (6.8)	<0.001
r^	85 (11.0)	78 (15.6)	0.017
ptoms mentioned during the call			
eased or loss of consciousness (n=1103)	49 (7.4)	21 (4.8)	0.081
drooping (n=713)	258 (54.3)	93 (39.1)	<0.001
weakness (n=772)	254 (51.0)	77 (28.1)	<0.001
weakness (n=653)	201 (49.0)	85 (35.0)	<0.001
ory disturbances (n=375)	192 (89.7)	150 (93.2)	0.243
munication problem in general (n=769)	413 (80.8)	187 (72.5)	0.008
sarthria (n=416)	181 (65.1)	76 (55.1)	0.047
sphasia (n=419)	163 (59.1)	72 (50.3)	0.089
n problem in general (n=184)	68 (78.2)	82 (84.5)	0.266

ırry vision (n=74)	27 (77.1)	27 (69.2)	0.444
)lopia (n=74)	14 (63.6)	23 (44.2)	0.127
duced vision (n=62)	15 (53.6)	22 (64.7)	0.374
dache (n=497)	147 (57.0)	140 (58.6)	0.718
of balance/motor coordination (ataxia)	130 (86.1)	66 (77.6)	0.097
36)			
ness (n=312)	120 (82.2)	143 (86.1)	0.338
ure (n=11)	4 (66.7)	3 (60.0)	0.819[&]
t term memory loss (n=68)	33 (76.7)	21 (84.0)	0.476
tness of breath (n=403)	62 (24.4)	25 (16.8)	0.072
nomic nervous system associated symptoms			
ating (n=208)	47 (36.7)	45 (56.3)	0.006
sea or vomiting (n=311)	84 (61.8)	94 (53.7)	0.155
r (n=255)	54 (32.7)	27 (30.0)	0.655
n skin (n=198)	18 (14.1)	12 (17.1)	0.563
ling of nearly) fainting (n=1103)	57 (8.6)	41 (9.3)	0.680
se of symptoms			
t of symptoms:			
acute (seconds) (n=211)	52 (44.1)	56 (60.2)	0.020
ute (minutes) (n=211)	46 (39.0)	23 (24.7)	0.028
adually (hours) (n=211)	20 (16.9)	14 (15.1)	0.710
tion of symptoms ≤4.5 hours (n=986)	381 (61.4)	203 (55.6)	0.077
otoms still present at time of calling (n=1254)	716 (93.4)	438 (89.9)	0.030
r characteristics			
r expresses concern (n=628)	334 (90.3)	248 (96.1)	0.006
nt never experienced similar symptoms	104 (49.8)	68 (42.8)	0.183
re (n=368)			
gnition of symptoms:			
A (n=368)	40 (19.1)	26 (16.4)	0.490
roke (n=368)	25 (12.0)	16 (10.1)	0.566

Netherlands Triage Standard; IQR: interquartile range; CVD: cardiovascular disease; TIA: transient ischaemic k. *Concerns all cardiovascular medication with the exception of antithrombotics; [#]Pearson Chi Square Test for gorical variables and Mann-Whitney U Test for not normally distributed continuous variables; [&]Fisher's Exact for categorical variables; ^Amongst others: vomiting, dyspnea, neck symptoms, insult, disability problems ('D ABCD').

Table 3. Final diagnoses of 1,269 patients who called the OHS-PC for symptoms suggestive of TIA/stroke

	High NTS urgency n=770 (60.7%)	Low NTS urgency n=499 (39.3%)	P-value
TIA/minor stroke	276 (35.8)	158 (31.7)	0.125
Major stroke*	149 (10.4)	52 (19.4)	<0.001
Other life threatening events (LTEs)**	45 (5.8)	16 (3.2)	0.032
- Intracerebral haemorrhage	17 (37.8)	5 (31.3)	0.640
- Subarachnoid haemorrhage	0 (0.0)	2 (12.5)	0.066^
Migraine	21 (2.7)	21 (4.2)	0.150
- With aura	9 (42.9)	7 (33.3)	0.525
Epilepsy	17 (2.2)	6 (1.2)	0.190
Syncope	18 (2.3)	12 (2.4)	0.939
Brain tumor	13 (1.7)	2 (0.4)	0.059^
Peripheral vestibular syndromes	22 (2.9)	42 (8.4)	<0.001
- Benign paroxysmal positional vertigo	10 (45.5)	11 (26.2)	0.119
- Meniere disease	1 (4.5)	1 (2.4)	0.999^
- Vestibular neuritis	0 (0.0)	5 (11.9)	0.155^
Peripheral nerve problem	75 (9.7)	47 (9.4)	0.850
- Bell's palsy	22 (29.3)	13 (27.7)	0.842
- Facial nerve palsy other than Bell's palsy	53 (70.7)	34 (72.3)	0.842
Psychogenic syndromes	27 (3.5)	26 (5.2)	0.138
Other non-urgent diagnoses***	107 (13.9)	117 (23.4)	<0.001

*Including lacunar infarction and stroke not otherwise specified; **Amongst others sepsis, acute coronary syndrome, meningitis, herpes encephalitis, coma, severe anemia due to gastrointestinal bleeding, hypoglycaemia, acute pulmonary embolism; *** Amongst others guillain barre, multiple sclerosis, alcohol intoxication; ^Fisher's Exact Test.

Table 4. Accuracy of adequate NTS urgency and final urgency allocation for detecting TIA/stroke/other LTEs

		Adequate NTS urgency allocation*** Value (95% CI)	Adequate final urgency allocation*** Value (95% CI)
TIA/stroke*	Sensitivity	0.71 (0.68-0.75)	0.86 (0.84-0.89)
	Specificity	0.46 (0.42-0.50)	0.38 (0.34-0.42)
	Positive predictive value	0.41 (0.38-0.43)	0.42 (0.40-0.44)
	Negative predictive value	0.75 (0.72-0.78)	0.84 (0.81-0.87)
Other LTEs**	Sensitivity	0.74 (0.61-0.84)	0.82 (0.70-0.91)
	Specificity	0.40 (0.37-0.43)	0.32 (0.30-0.35)
	Positive predictive value	0.06 (0.05-0.07)	0.06 (0.05-0.06)
	Negative predictive value	0.97 (0.95-0.98)	0.97 (0.95-0.98)
TIA/stroke and other LTEs	Sensitivity	0.72 (0.68-0.75)	0.86 (0.83-0.89)
	Specificity	0.48 (0.43-0.52)	0.40 (0.36-0.44)
	Positive predictive value	0.62 (0.60-0.64)	0.63 (0.62-0.65)
	Negative predictive value	0.58 (0.54-0.62)	0.70 (0.66-0.74)

*Prevalence TIA/minor stroke 34.2% and prevalence major stroke 15.8%; **Prevalence other LTEs 4.8%; ***For TIA/minor stroke urgencies U1, U2 and U3 were all considered adequate, for major stroke and other LTEs urgencies U1 and U2 were considered adequate.

Figures

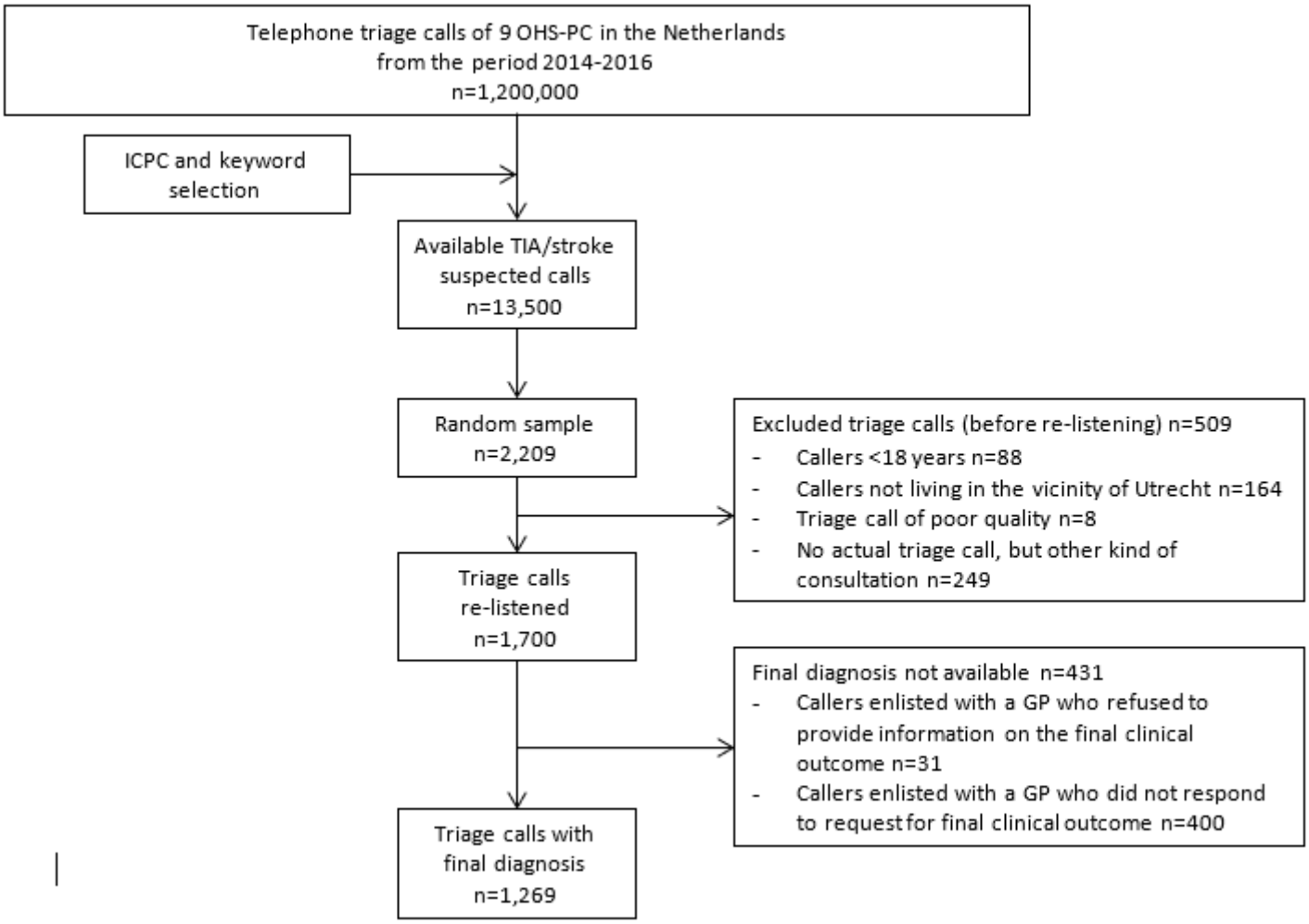

Figure 1

Flowchart study population

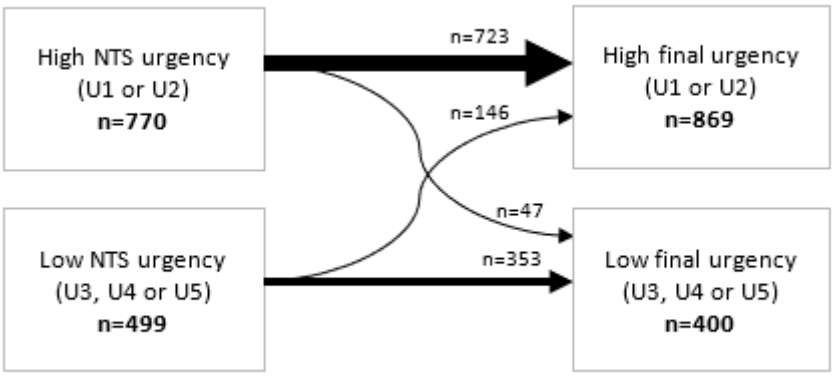

Figure 2

NTS urgency adjustments of 1,269 patients with symptoms suggestive of TIA/minor stroke Legend: This Figure does not show differences within the high and low urgency groups, for the differences within all

urgency groups (U1-U5) see supplementary data Table S2.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementarydataAccuracyNTS.pdf
- STROBEchecklistcrosssectional.docx