Dizziness in males and females suspected of transient ischemic attack or stroke in out-of-hours primary care

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Abstract

Background: Early recognition and diagnosis of transient ischemic attack (TIA) and stroke is of great importance for early intervention and prognosis. Dizziness can be a symptom of TIA or stroke, but also a mimic if it is due to the vestibular system, which makes that presence of this symptom may cause misdiagnosis.
We aimed to assess the relation between dizziness and (i) the urgency allocation and (ii) the diagnosis TIA or stroke in patients calling the out-of-hours service primary care with symptoms suggestive of TIA or stroke.

Methods: A retrospective observational study which was executed in nine out-of-hours service primary care locations in the Netherlands between 2014 and 2016. Information was collected on patient and call characteristics, symptoms and urgency allocation at the OHS-PC and follow-up data was retrieved from the patients' own general practitioner. Patients reporting dizziness were compared to patients without dizziness. Univariate and multivariate logistic regression analysis was performed to assess the relation between dizziness and (i) the urgency allocation and (ii) the diagnosis of TIA or stroke.

Results: In total, 1,953 recordings were analyzed. Dizziness was present in 374 (19.2%) patients, and they received less often a high urgency allocation than patients without dizziness; crude odds ratio (OR) 0.45; 95% confidence interval (CI) 0.35-0.56, p<0.001, and adjusted OR 0.59; 95% CI 0.42-0.81, p=0.001 after correction for age, male sex and prior history of TIA or stroke. Patients with dizziness less often had a TIA or stroke; crude OR of 0.66, 95% CI 0.50-0.85, p=0.002, and adjusted OR 0.77, 95% CI 0.51-1.14, p=0.191 after correction for age, male sex and history of TIA or stroke. No differences were found between males and females regarding the crude OR for TIA or stroke.

Conclusion: Patients with suggestive symptoms of TIA or stroke who also reported dizziness received a lower urgency allocation and were less likely to have a TIA or stroke than patients without reporting dizziness, a relation that was similar among females and males.

List of abbreviations:
CI: confidence interval
GP: general practitioner
IQR: interquartile range
NTS: Netherlands Triage System
OHS-PC: out-of-hours service primary care
OR: odds ratio
TIA: transient ischemic attack

Introduction

Stroke is defined as an episode of acute neurological dysfunction presumed to be caused by ischemia or hemorrhage, with symptoms persisting ≥24 hours or until death.[1] Transient ischemic attack (TIA) is generally described as a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction.[2] Stroke remains among the worldwide leading causes of death and disability.[3] In 2020, there were approximately 40,000 strokes and 53,000 TIA cases in the Netherlands. Roughly 80% of all strokes is caused by ischemia and 20% is hemorragic.[4] Ischemic strokes can be subdivided into anterior and posterior circulation strokes. A fifth of all TIAs and strokes occur in the posterior circulation arterial territory.[5] Early recognition and diagnosis of patients with TIA or stroke is crucial for early interventions. A timely start of treatment minimizes the risk of (permanent) brain damage and stroke recurrence. However, recognizing TIA and stroke can be challenging because other diseases may mimic its clinical presentation, e.g., migraine, seizures, and peripheral vestibular disorders. Another complicating factor is that TIA and stroke may cause a myriad of symptoms very much depending on which part of the circulation is affected. As already mentioned, symptoms caused by blockade in the anterior circulation are most common and may result in unilateral weakness, numbness or a loss of sensation, amaurosis fugax, and dysarthria. Symptoms caused by posterior circulation obstruction are (more) bi-lateral; dizziness, ataxia, dysphasia, eye movement disorders causing diplopia, bilateral weakness and when the more the obstruction is located in the region of the brain stem, a reduction in consciousness may be seen.[5,6] However, clinical manifestations between anterior and posterior circulation strokes can have a high degree of similarity, e.g. eye and speech disorders.[7]

Acute dizziness is among the most common causes for seeking 'emergency' primary care. However, the differential diagnosis is challenging, starting with defining what dizziness is. Patients use to express themselves mentioning one or more of numerous sensations, e.g. vertigo, lightheadedness, disequilibrium, pre-syncope, unsteadiness, or just 'not feeling well'.[8] Secondly, dizziness may be caused by many disorders varying from life-threatening to rather normal physiologic responses.[9] Importantly, dizziness is not strongly related to stroke; in only 3% of patients presenting to the emergency department with dizziness as the main symptom, stroke was the underlying condition.[8] Nevertheless, acute dizziness is one of the key symptoms in patients with obstruction in the posterior circulation and thus can be either a main symptom as a mimic in patients presenting with neurological deficit symptoms, and it thus is problematic during assessment, certainly when the initial triage is by telephone. Both over-triage as under-triage with missed opportunities for interventions may be the result.[10]

In the Netherlands, the vast majority of patients with symptoms suggestive of TIA or stroke first contact the general practitioner (GP). During evenings, nights, weekends and holidays, patients can contact the out-of-hours services in primary care (OHS-PC).[11] The telephone triage at the OHS-PC is performed by trained nurses, supervised by GPs. Triage nurses are supported by a semi-automatic decision support tool called the Netherlands Triage Standard (NTS). The NTS generates an urgency level based on the severity of the patients' complaints. The six urgency levels are linked to a certain time range within which a GP or ambulance should see the patient (**Table 1**). In 2016, a survey among GPs revealed that 84% of the GPs believed that the implementation of the NTS has resulted in many unnecessary consultations

and home visits and a high workload at the OHS-PC because of unnecessary high urgency allocations.[12]
The aim of the Safety First study is to improve both efficiency and safety of telephone triage in patients calling the OHS-PC with symptoms suggestive of acute cardiovascular disease, e.g., suspected of acute coronary syndrome or TIA or stroke.[13]
In this study, we aimed to assess the relation between acute dizziness and (i) the urgency allocation and (ii) the diagnosis of TIA or stroke in patients contacting the OHS-PC with potential neurological deficit symptoms.

***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 h	Home visit by GP or appointment at OHS-PC
U3 – Urgent	Possible risk of damage, humane reasons	Within a few hours (< 3 hours)	Home visit by GP or appointment at OHS-PC
U4 – Non-urgent	Marginal risk of damage	Within 24 hours	Appointment at OHS-PC or telephone advice
U5 – Advice	No risk of damage	Advice, not time related	Telephone advice

Abbreviations: NTS, Netherlands Triage Standard; GP, general practitioner; OHS-PC, out-of-hours services in primary care.

Methods

Study design

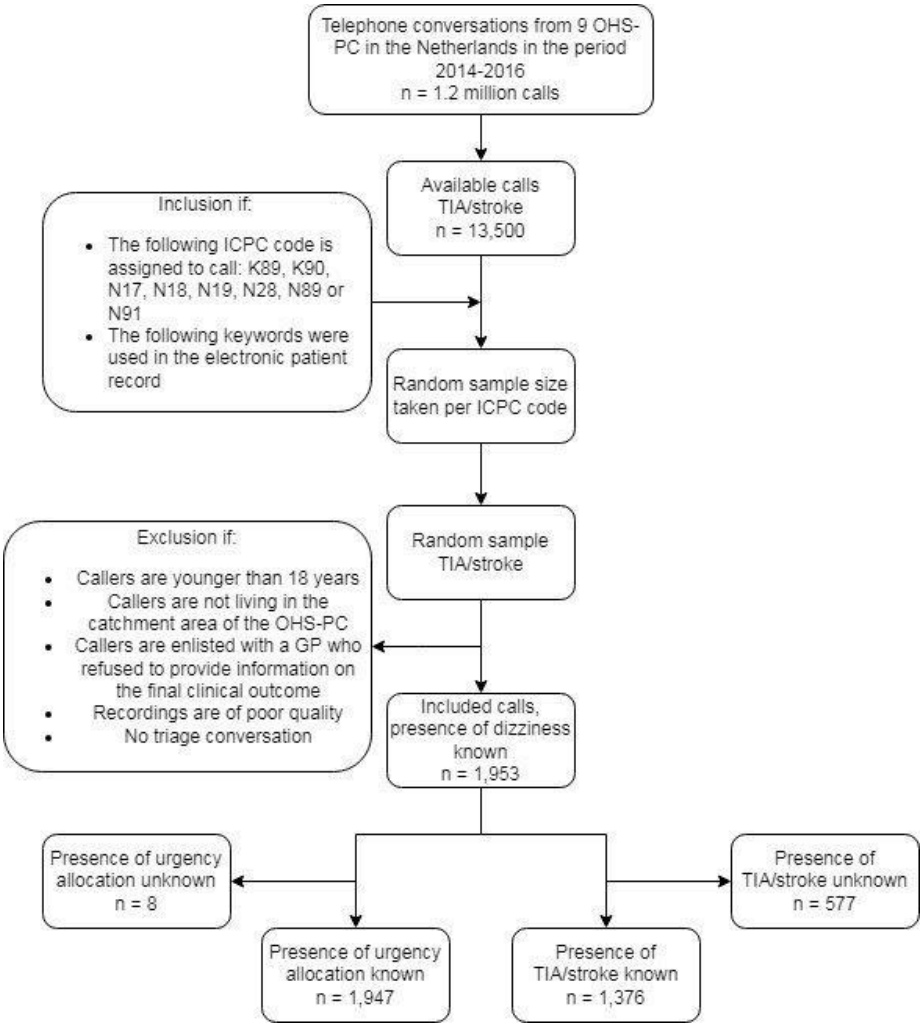
The Safety First study is a retrospective observational study that analyzed real-life telephone triage recordings in nine OHS-PC locations around Utrecht, the Netherlands between 2014 and 2016. These calls were selected based on International Classification of Primary Care codes (K89, K90, N17, N18, N19, N29, N89 and N91) and the following keywords: TIA, stroke, neurological deficit, cerebral or brain bleeding or haemorrhage or infarction, arm or leg weakness, face or mouth drooping, sensory disturbances or speech or visual problems. After application of these codes, 13,500 calls suspected of TIA or stroke were available. Records were excluded based on the following criteria: (i) patients were of younger age than 18 years, (ii) patients were not living in the catchment area of the OHS-PC, (iii) patients were enlisted with a GP who refused to provide information on the final clinical outcome, (iv) records were of poor quality, and finally (v) call was of poor auditive quality. This resulted in 1,953 recordings that were included in this study (**figure 1**).

Data collection

Triage conversations were listened to by student researchers and information about patient characteristics, conversation characteristics, symptoms, and urgency allocation was collected in a standardized case record form. Follow-up data was retrieved by contacting patients' GPs. The GPs were asked to provide information about final diagnosis, prescribed medication, and possible intervention.

The Safety First study was approved by the Medical Ethics Committee of the University Medical Centre Utrecht.

Figure 1. *Flowchart of the study population.*



Data analyses

Differences in patient characteristics were compared between two groups of patients with symptoms suspected of TIA or stroke: (i) patients with acute dizziness and (ii) patients without dizziness. Patients in whom the presence of dizziness was not discussed, were considered as not having dizziness. We considered dizziness present if patients use the wording dizziness/vertigo or light-headedness. Numbers and percentages are presented for categorical variables. Medians and interquartile ranges (IQR) are presented for continuous variables. The Pearson Chi-square test was used for comparing categorical variables and the independent T-test was used for comparing continuous variables. The final diagnosis was dichotomized into no TIA/stroke and TIA/stroke. The final urgency was dichotomized into high urgency (U1 and U2) and low urgency (U3, U4 and U5). Univariate and multivariate logistic regression was performed to assess the relation between dizziness and the urgency allocation and between dizziness and the outcome TIA or stroke, in both males and females. The odds ratios (OR) with the 95% confidence intervals (CI) were calculated. A p-value of <0.05 was considered statistically significant. Data analysis was performed with IBM SPSS Statistics 26.0.0.1.

Results

Baseline characteristics

The characteristics of the 1,953 included patients are summarized in **table 2**. Dizziness was present in 374 (19.2%) patients and considered absent in 1579 (80.8%) patients. The median age was 73 (IQR 35) years and 44.3% were male. Those with dizziness were less often males (39.0% vs. 45.6%, p=0.022), the median duration of the call was longer than in patients without dizziness (0:08:22 vs 0:06:55, p<0.001), and more often the patient called him/herself (29.4% vs 22.5%, p=0.005) in this group. Symptoms were more often still present at time of calling in the 'dizziness group' (95.9% vs. 91.4%, p=0.004) and ataxia was more common (90.5% vs. 79.5%, p=0.015) than in those without dizziness. They had less often face drooping (32.7% vs. 49.5%, p<0.001) and arm weakness (34.9% vs. 43.8%, p=0.017).

Table 2. *Baseline characteristics of 1,953 patients who called the OHS-PC for symptoms suspected of transient ischemic attack or stroke, subdivided into patients with dizziness and patients without dizziness.*

Baseline characteristics		Total No. (%) n=1953	Dizziness No. (%) n=374	No dizziness No. (%) n=1579	P-value
Caller characteristics	Median age (IQR) (n=1953)	73 (35)	71 (26)	73 (26)	0.171
	Male sex (n=1953)	866 (44.3)	146 (39.0)	720 (45.6)	**0.022**
Call characteristics	Median duration in hh:mm:ss (IQR) (n=1953)	0:07:11 (0:04:31)	0:08:22 (0:04:38)	0:06:55 (0:04:26)	**<0.001**
	Median introduction time in hh:mm:ss (IQR) (n=1953)	0:00:19 (0:00:16)	0:00:19 (0:00:16)	0:00:19 (0:00:16)	0.845
	Patient calls themselves (n=1950)	465 (23.8)	110 (29.4)	355 (22.5)	**0.005**
Medical history	History of TIA/stroke (n=996)	567 (56.9)	100 (51.5)	467 (58.2)	0.092
	Cardiovascular disease (n=1348)	1058 (78.5)	214 (76.2)	844 (79.1)	0.285
	Hypertension (n=647)	328 (50.7)	74 (49.0)	254 (51.2)	0.635
	Hypercholesterolemia (n=565)	234 (41.4)	44 (35.5)	190 (43.1)	0.129
	Diabetes Mellitus (n=626)	241 (38.5)	50 (35.7)	191 (39.1)	0.442
	Epilepsy (n=360)	43 (11.9)	6 (7.2)	37 (13.4)	0.131
	Migraine (n=146)	47 (32.2)	6 (25.0)	41 (33.6)	0.409
	Antithrombotic use (n=1450)	697 (48.1)	136 (47.6)	561 (48.2)	0.845
Symptom characteristics	Duration <4,5 hours (n=1481)	903 (61.0)	170 (63.4)	733 (60.4)	0.362
	Symptoms still present at time of calling (n=1922)	1774 (92.3)	354 (95.9)	1420 (91.4)	**0.004**
	Facial drooping (n=1119)	528 (47.2)	51 (32.7)	477 (49.5)	**<0.001**
	Arm weakness (n=1233)	522 (42.3)	73 (34.9)	449 (43.8)	**0.017**
	Leg weakness (n=1038)	451 (43.4)	66 (37.9)	385 (44.6)	0.108
	Sensory disturbances (n=553)	501 (90.6)	80 (87.9)	421 (91.1)	0.337
	Ataxia (n=358)	295 (82.4)	86 (90.5)	209 (79.5)	**0.015**

Abbreviations: IQR = interquartile range

Urgency allocation

Of the patients with dizziness, 55.1% received a high urgency allocation compared to 73.3% of the patients without dizziness, with a crude OR of 0.45 (95% CI 0.35-0.56, p<0.001) (**table 3**). After correction for age, male sex and history of TIA/stroke, this association remained significant (adjusted OR 0.59, 95% CI 0.42-0.81, p=0.001) (**table 4**). The association between dizziness and the urgency allocation for males and females separately is shown in **table 5 and 6**. The crude OR was 0.42 (95% CI 0.29-0.60, p<0.001) for males and 0.47 (95% CI 0.35-0.64, p<0.001) for females (**table 5**). After correction for age and history of TIA/stroke, the adjusted OR was 0.54 (95% CI 0.32-0.90, p=0.018) for males and 0.63 (95% CI 0.41-0.96, p=0.032) for females (**table 6**).

Table 3. *Relation between dizziness and urgency allocation in patients suspected of TIA/stroke.*

	High urgency No. (%)	**Low urgency** No. (%)	**Odds ratio (95% CI)**	**P-value**
Dizziness	206 (55.1)	168 (44.9)		
			0.45 (0.35-0.56)	<0.001
No dizziness	1153 (73.3)	420 (26.7)		

Table 4. *Univariate and multivariate relation between dizziness and high urgency allocation with adjustment for age, male sex and history of TIA/stroke.*

Univariate logistic regression	**Crude OR (95% CI)**	**P-value**
Dizziness	0.45 (0.35-0.56)	<0.001
Multivariate logistic regression	**Adjusted OR (95% CI) of dizziness**	**P-value**
Adjusted for age	0.45 (0.36-0.57)	<0.001
Adjusted for age and male sex	0.46 (0.36-0.58)	<0.001
Adjusted for age, male sex and history of TIA/stroke	0.59 (0.42-0.81)	0.001

Table 5. *Relation between dizziness and urgency allocation in males and females suspected of TIA/stroke.*

		High urgency No. (%)	**Low urgency** No. (%)	**Odds ratio (95% CI)**	**P-value**
Males	Dizziness	79 (54.1)	67 (45.9)		
				0.42 (0.29-0.60)	<0.001
	No dizziness	531 (74.0)	187 (26.0)		
Females	Dizziness	127 (55.7)	101 (44.3)		
				0.47 (0.35-0.64)	<0.001
	No dizziness	622 (72.7)	233 (27.3)		

Table 6. *Univariate and multivariate relation between dizziness and high urgency allocation with adjustment for age and history of TIA/stroke in males and females separately.*

Multivariate logistic regression		Adjusted OR (95%) of dizziness	P-value
Males	Adjusted for age	0.42 (0.29-0.61)	<0.001
	Adjusted for age and history of TIA/stroke	0.54 (0.32-0.90)	0.018
Females	Adjusted for age	0.48 (0.36-0.65)	<0.001
	Adjusted for age and history of TIA/stroke	0.63 (0.41-0.96)	0.032

Final diagnosis of TIA or stroke

Of the patients with dizziness 44.8% were diagnosed with TIA or stroke (45.0% in males and 44.7% in females) compared to 55.3% of the patients without dizziness (56.9% in males and 54.0% in females), with a crude OR of 0.66 (95% CI 0.50-0.85, p=0.002) (**table 7**). However, this association was no longer significant after correction for age, male sex and history of TIA or stroke (adjusted OR 0.77, 95% CI 0.51-1.14, p=0.191) (**table 8**). The association between dizziness and the final diagnosis of TIA or stroke for males and females separately is shown in **table 9 and 10**. The crude OR was 0.62 (95% CI 0.41-0.94, p=0.024) for males and 0.69 (95% CI 0.49-0.97, p=0.032) for females (**table 9**). After correction for age and history of TIA or stroke, this association was no longer significant with an adjusted OR of 0.75 (95% CI 0.41-1.36, p=0.341) for males and 0.80 (95% CI 0.47-1.37, p=0.416) for females (**table 10**).

Table 7. *Relation between dizziness and final diagnosis of TIA/stroke in patients suspected of TIA/stroke.*

	TIA/stroke No. (%)	**No TIA/stroke** No. (%)	**Odds ratio (95% CI)**	**P-value**
Dizziness	125 (44.8)	154 (55.2)		
			0.66 (0.50-0.85)	0.002
No dizziness	607 (55.3)	490 (44.7)		

Table 8. *Univariate and multivariate relation between dizziness and final diagnosis of TIA/stroke with adjustment for age, male sex and history of TIA/stroke.*

Univariate logistic regression	**Crude OR (95% CI)**	**P-value**
Dizziness	0.66 (0.50-0.85)	0.002
Multivariate logistic regression	**Adjusted OR (95% CI) of dizziness**	**P-value**
Adjusted for age	0.67 (0.51-0.89)	0.006
Adjusted for age and male sex	0.68 (0.51-0.90)	0.008
Adjusted for age, male sex and history of TIA/stroke	0.77 (0.51-1.14)	0.191

Table 9. *Relation between dizziness and final diagnosis of TIA/stroke in males and females suspected of TIA/stroke.*

		TIA/stroke No. (%)	**No TIA/stroke** No. (%)	**Odds ratio (95% CI)**	**P-value**
Males	Dizziness	49 (45.0)	60 (55.0)		
				0.62 (0.41-0.94)	0.024
	No dizziness	279 (56.9)	211 (43.1)		
Females	Dizziness	76 (44.7)	94 (55.3)		
				0.69 (0.49-0.97)	0.032
	No dizziness	328 (54.0)	279 (46.0)		

Table 10. *Univariate and multivariate relation between dizziness and final diagnosis of TIA/stroke with adjustment for age and history of TIA/stroke in males and females separately.*

Multivariate logistic regression		**Adjusted OR (95%) of dizziness**	**P-value**
Males	Adjusted for age	0.60 (0.39-0.93)	0.023
	Adjusted for age and history of TIA/stroke	0.75 (0.41-1.36)	0.341
Females	Adjusted for age	0.75 (0.51-1.09)	0.132
	Adjusted for age and history of TIA/stroke	0.80 (0.47-1.37)	0.416

Discussion

In this study, the relation between dizziness, the urgency allocation and the final diagnosis of TIA or stroke was assessed in patients suspected of TIA or stroke who contacted the OHS-PC. Patients with dizziness received less often a high urgency allocation than patients without dizziness (crude OR 0.45, 95% CI 0.35-0.56, p<0.001), a relation that remained significant after adjustment for age, male sex and history of TIA or stroke (adjusted OR 0.59, 95% CI 0.42-0.81, p=0.001). Patients with dizziness were less often diagnosed with TIA or stroke compared to patients without dizziness (crude OR 0.66, 95% CI 0.50-0.85, p=0.002), but this relation was no longer significant after adjustment for age, male sex and history of TIA or stroke (adjusted OR 0.77, 95% CI 0.51-1.14, p=0.191). No differences were found between males and females in the relation between dizziness and urgency allocation or diagnosis of TIA or stroke.

To the best of our knowledge, this is the first study to describe the relation between dizziness, the urgency allocation, and the final diagnosis TIA or stroke in the OHS-PC setting. Recently, Packendorff et al. evaluated the prehospital assessment among 1887 patients with dizziness who called the emergency medical service in Sweden. Patients with dizziness were given a lower priority by the emergency medical service crew compared to the average patient who calls the emergency medical service.[14] This is in line with our finding that patients with dizziness received a lower urgency allocation compared to patients without dizziness, although dizziness is one of the symptoms that could be present if patients have a posterior circulation TIA or stroke, which is altogether 20% of all TIAs and strokes.

Recognizing acute dizziness as a symptom of a central cerebrovascular disease is difficult and misdiagnoses are common. Arch et al. analysed misdiagnosed strokes in the emergency department, and they reported that 37% percent of posterior circulation strokes were initially misdiagnosed compared with 16% of the anterior circulation strokes. Furthermore, dizziness was one of the symptoms related to missed strokes together with headache, nausea/vomiting, seizure, syncope, and difficulty walking.[15] These studies highlight the difficulties with dizziness in patients with neurological deficit symptoms, certainly when they need to be assessed by telephone by triage nurses.

We included all patients who reported dizziness, e.g., vertigo, light-headedness, unsteadiness, and dizziness unspecified. Importantly, however, patients experience difficulties in describing what exactly they feel when mentioning that they are dizzy. Complicating is that vestibular disorders may present with various patterns of dizziness, while cardiac disorders/systemic hypotension may give rise to vertigo (which is often considered a typical symptom for vestibular disorder). Therefore, subdividing dizziness seems not useful for diagnosis.[16] Timing (e.g., acuteness, episode duration and frequency) and triggers (e.g., standing quickly, head motion) seem to be more reliable and helpful in diagnosis. Dizziness in TIA or stroke occurs acutely and has a prolonged duration compared to vestibular dizziness/vertigo.[17] Cheung et al. identified factors correlating with central neurological causes of dizziness; (i) age ≥65 years, (ii) concurrent presence of acute ataxia symptom or focal neurological symptoms, and (iii) history of previous stroke or diabetes mellitus were factors that increased the odds of a central neurological cause of dizziness.[18] This knowledge could possibly aid triage nurses in differentiating between various causes of dizziness.

Strengths and limitations

A strength of our study is that there was no risk of recall or hindsight bias as data was collected from real-life triage conversations, and researchers were unaware of patient outcomes at the time of data collection. Another strength is that the database was large, and data was collected from nine OHS-PC locations in both rural and urban areas in the Netherlands, which makes that the results are generalizable to the Dutch OHS-PC setting.

One of the limitations is that in 29.5% of the patients, data about the final diagnosis was missing because GPs refused to provide this information. It is implausible that refusal of GPs to provide information is related to outcomes in patients, and therefore it seems unlikely that this selection might have resulted in selection bias. Secondly, data was missing on some variables, which is a common finding in research with routine care data. Those not spontaneously mentioning dizziness or after asking for it were considered as 'no dizziness' which may have caused underestimation of the effect. Finally, data was collected by multiple student researchers, which might have induced inter-observer variability.

Conclusion

Patients with dizziness received a lower urgency allocation and less likely had a TIA or stroke, but the relation with TIA or stroke was no longer significant after correction for age, male sex and history of TIA or stroke. Triage nurses should be alert for acute dizziness which is reported in combination with acute ataxia or focal neurological symptoms.

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