Does involvement of the supervising general practitioner impact urgency allocation and diagnosis of acute coronary artery syndrome in patients with chest discomfort who contact out-of-hours primary care?

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Abstract

***Background*:** Primary care triage nurses use a semi-automatic decision support tool called the 'Netherlands Triage Standard' for telephone triage during out of office hours. In some cases, the triage nurse consults the supervising general practitioner (GP) to decide on the urgency allocation. The aim of this study is to evaluate the relation between consulting the supervising GP and (i) the urgency allocation and (ii) the diagnosis of ACS and other life-threatening events (LTEs) in patients calling the OHC-PC with chest discomfort.

***Methods*:** Patient call characteristics and follow-up data were retrieved from recorded phone calls, and GPs' electronic medical files, respectively. Patients in whom the supervising GP was involved were compared with patients in whom not. Logistic regression was used to analyse data and calculate odds ratios (ORs) for the relation between involvement of the supervising GP and urgency allocation and the diagnosis of ACS/other LTE or ACS alone.

***Results*:** 2,195 patients were included in this study. In 1,148 (52.2%) the supervising GP was consulted, and there were no clear differences in symptoms with patients in whom the GP was not consulted, however they were on average three years younger and had more comorbidities. This resulted if compared to patients in whom the supervising GP was not involved in a higher urgency allocation (OR 1.26 (95% CI 1.06-1.50)), but a lower -non-significant- occurrence of ACS or other LTE (OR 0.79 (95% CI 0.63-1.01)) or ACS alone (OR 0.79 (95% CI 0.61-1.03)). This relation was significant after correction for age and sex (adjusted OR 0.75 (95% CI 0.59-0.96), and 0.75 (95% CI 0.57-0.98), respectively). These results were mainly driven by females; OR of ACS/other LTE in 'consulted' group 0.68 (95% CI 0.47-0.98)), males OR 0.86 (95% CI 0.63-1.19).

In the 215 (9.8%) patients who eventually showed to have an ACS and in whom the supervising GP was involved, less often a high urgency was allocated (OR 0.32 (95% CI 0.17-0.61)); females OR 0.24 (95% CI 0.08-0.69), males OR 0.39 (95% CI 0.17-0.87). In both the 'consulted' group with ACS as in the 'not consulted' ACS group, the NTS-generated low urgency cases were overruled to a high urgency just as often (23.9% vs 22.7%). The NTS-generated urgency was downgraded to low urgent in 2 cases (2.8%) in the 'consulted' group and in no case (0.0%) in the 'not consulted' group.

***Conclusion*:** In half of the patients, the supervising GP was involved, and they had similar symptoms as patients in those in whom no consultation took place. These patients were diagnosed less with an ACS but received more often a high urgency allocation. However, this discrepancy was completely driven by patients who had no ACS, more so in females. This suggests that patients in whom the GP was consulted were more difficult to triage resulting in relative over-triage of those without ACS or other LTE.

Abbreviations:

OHS-PC: out-of-hours service in primary care
GP: general practitioner
NTS: Netherlands Triage Standard
ACS: acute coronary syndrome
SAE: serious adverse event
LTE: life-threatening event

Introduction

About 20 years ago, the Dutch out-of-hours service in primary care (OHS-PC) changed the way of healthcare delivering. Since then, out-of-hours primary care is centralized to large-scale general practitioner (GP) cooperative centra. (1) For medical help during OHS, patients primarily contact these (OHS-PC services or, in case of an evident life-threatening situation, directly call the emergency number 112. When patients call the OHS-PC, triage nurses perform the telephone triage aiming to categorize patients in level of urgency, which is related to time within a patient should be seen by either a GP or ambulance. (1–4) Since 2011, triage nurses use a semi-automatic digital triage tool called the 'Netherlands Triage Standard' (NTS). (2) The NTS aims to contribute to more consistent, effective, and adequate identification of high urgent cases. Besides it was considered to help lowering the workload for GPs under the promises that low urgent cases could be helped with standardized self-care advice by the triage nurse. (3,4)

The first step in the NTS is to assess whether the patient who calls or for whom is called is hemodynamic stable, by using the ABCD method. (2) If the patient is ABCD unstable, the NTS system will generate the highest level of urgency (U0) immediately, recommending direct dispatch of an ambulance. However, nearly all patients calling the OHS-PC are ABCD stable because bystanders can also call 112 in evident medical urgencies. After passing the 'ABCD check', the triage nurse has to choose the medically most critical complaint out of the reason for encounter of the patient. After the triage nurse has selected one of the 56 'entrance complaints', the NTS system automatically presents around five standardized questions related to this 'entrance complaint'. After the questions are filled out by the triage nurse, the system automatically generates an urgency allocation; one out of five remaining urgency levels (U1-U5) each corresponding with a time frame within a doctor or ambulance should see the patient (Table 1). (2,4,5)

Table 1: Netherlands Triage Standard (NTS), urgency levels (2,4)

Urgency code	Urgency category	Description	Response time
U0	Resuscitation	Failure of vital functions	Immediate
U1	Life-threatening	Vital functions are unstable	Immediate
U2	Emergent	Vital functions are threatened	Within 1 hour (soon as possible)
U3	Urgent	Risk for damage	Within a few hours
U4	Nonurgent	Negligible risk for damage	Within 24 hours
U5	Advice	No risk for damage	Next working day

Based on the generated urgency level, the triage nurses can select out of (i) calling an ambulance, (ii) a home visit by a GP, (iii) a GP consultation at the OHS-PC, (iv) a phone call by the GP, or (v) give a self-care advice. (4,5) If in doubt about the generated NTS urgency level, the nurse can overrule this urgency. In 13.2% of all patients calling OHS-PC suspected of ACS and in 42.6% of patients suspected of TIA/stroke, the triage nurse overruled the NTS-generated urgency level. More often upgrading to a higher urgency than downgrading to a lower urgency. (6,7) In 5.6% of all patients with chest discomfort the triage nurse overruled any NTS generated urgency level to allocate an U1 urgency level. The triage nurse overruled 13.5% of all cases to eventually allocate an U2 urgency level, however this includes both downgrading from U1 and upgrading from U3-5. (8) About overruling or other questions,

triage nurses can consult the supervising GP for advice and authorization of the urgency allocation. (3,5,6,9)

Since the introduction of the NTS, an increase in high urgency allocations was registered, while the distribution of (severity of) disease seemed not to have changed. (8,10) This suggests a defensive strategy which may result in unnecessary consultations and an increase in workload for GPs during OHS, but also for other health care workers in the 'acute chain' such as ambulance and emergency department (ED) personnel. This may be the price of better safety, but if selectively more non-urgent cases are upgraded, then also safety will decrease for those really needing it, due to 'jamming'.

In the top five of reasons for contacting the OHS-PC is chest discomfort. With a lifetime prevalence of 20-40% it is also a very common reason for contacting the OHS-PC, and it is the most important reason for allocating an U1 urgency level. (11,12) After, evaluation at the hospital, around 11% shows to have an acute coronary syndrome (ACS) and another 1.5% other life-threatening events (LTEs). (12,13) Symptoms of ACS can be difficult to interpret, especially if only assessed by phone. This can result in over-triage in patients with chest discomfort. Recent studies showed that triage nurses in almost 70% of all patients with acute chest pain dispatched an ambulance, while only 10% of all patients with this symptom suffered from a cardiovascular problem. (6,13,14) On the other hand, ACS is also missed in patients calling OHS-PCs for chest discomfort, and missing an ACS represents 30.4% of all calamities at OHS-PCs (0.006% of all calls), resulting in severe (permanent) injury or death. (3,6,14) In addition, the NTS tool underestimated the level of urgency in about 27% of patients who eventually showed to have an ACS/other LTEs. Overruling by the triage nurse improved this, but still 14% was allocated a too low urgency level. (6) This is contrasting to the result of a questionnaire study that reported that 80% of the GPs consider that -overall- too many patients are seen at the OHS-PC while having low urgency complaints that could wait for daytime consultation. Moreover, they considered a more active involvement of the supervising GP could have a beneficial effect in that less often patients would be seen with a low urgency problem. (15) It is clear that the triaging at the OHS-PC can still be improved in efficiency and safety for those with acute chest discomfort.

In a case-control study it was shown that in cases who showed to have a serious adverse event (SAE), the supervising GP was significantly more often consulted by the triage nurse than in similar cases, without SAE cases, all cases from the domain chest discomfort. Thus, suggesting that these calls were more difficult to triage for triage nurses. The SAE cases received less often a high urgency allocation than the control group. (16) Another study showed that GPs were capable of identifying ACS among patients with acute chest discomfort with a sensitivity of 86% (14% false positives), but only able to rule ACS out with a specificity of 51% (false negatives 49%). (17)

It is still unclear what the effect is of involving the supervising GP when someone calls for chest discomfort; whether it positively or negatively affects the efficiency and safety of the triage. The aim of this study is to evaluate the relation between consulting the supervising GP and (i) the urgency allocation and (ii) the diagnosis of ACS in patients calling the OHC-PC with chest discomfort.

Methods

This study is part of the Safety First study; an observational cohort study in patients calling the OHS-PC with symptoms suggestive of ACS (e.g. chest discomfort) or TIA/stroke (e.g. neurological deficit related symptoms such as loss of power in one of the arms). The aim of the Safety First study is to understand, validate and optimize current triage system and urgency allocation in patients calling with symptoms suspected of ACS. Safety First contains data obtained from nine OHS-PCs in the Netherlands. Data include phone call recordings, records of the OHS-PCs and follow-up information from the patient's GP.
This sub-study will evaluate the relationship between involvement of the supervising GP and (I) urgency allocation and (II) diagnosis of ACS (and other LTEs).

Study population

Patients who called one of the OHS-PCs between 2014 and 2017 with symptoms suggestive for ACS were included. The selection was based on specific International Classification of Primary Care (ICPC) codes and a selection of keywords used in the electronic patient record of the OHS-PC (see Figure 1). Exclusion criteria were (1) callers younger than 18 years, (2) callers not living in the vicinity of the OHS-PC, (3) the patient's GP refusing to provide information on the clinical outcome, (4) no real triage conversation, (5) poor quality recordings.

Data collection

Characteristics from patients, situation and urgency allocation were collected by listening to recordings and scrutinizing OHS-PC patient files. Information about the final diagnosis was obtained by collecting follow up data at the patient's own GP including specialist letters.

Data analyses

Baseline characteristics were compared between patients in whom the supervising GP was consulted and those in whom not, using the chi-square test for dichotomous variables and independent t-test for continuous variables. Urgency levels were dichotomized in high urgency (U1 and U2) and low urgency (U3, U4, U5). The relation between consulting the supervising GP and (I) the final urgency allocation and (II) the outcome ACS was analysed with logistic regression analysis calculating crude odds ratios (ORs). After corrections for age and sex the adjusted ORs were calculated with multivariable logistic regression. Statistically significance was defined as a p-value lower than 0.05. Data analysis was performed using IBM SPSS Statistics.

Ethical considerations

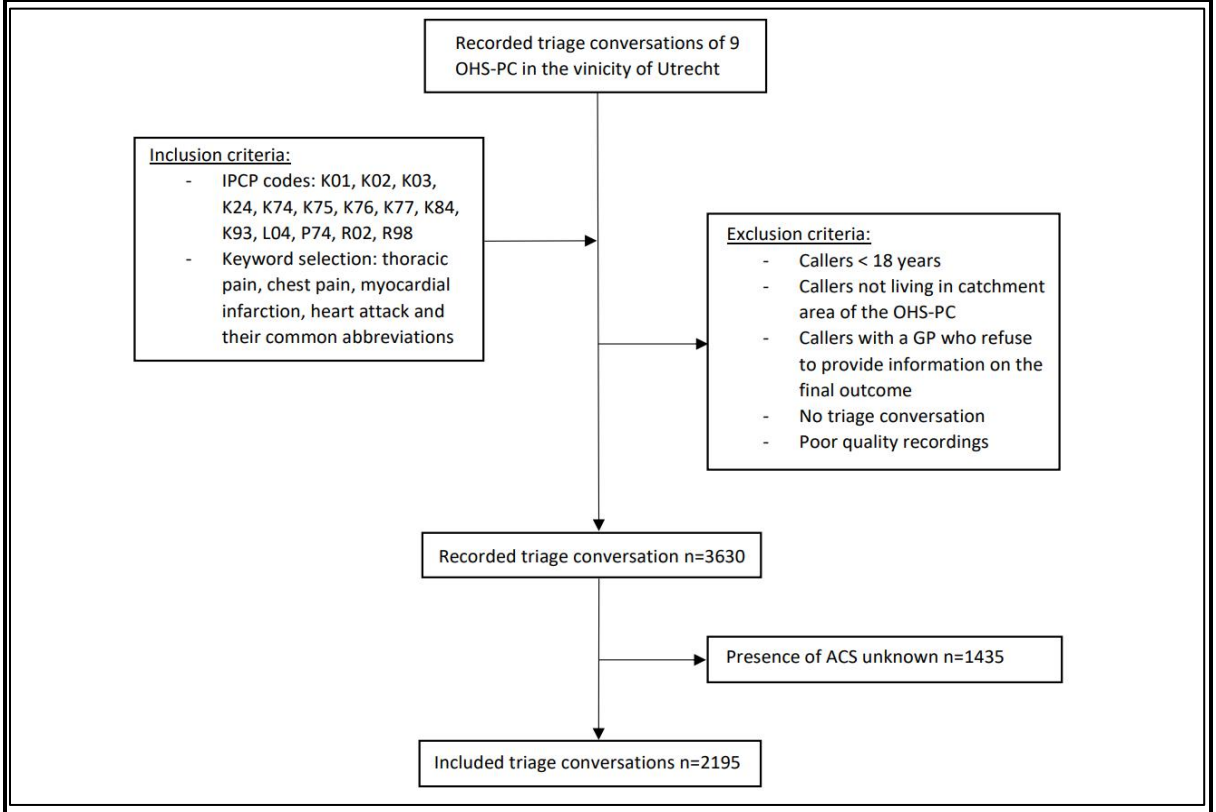
The medical Ethics Committee of the University Medical Center Utrecht, the Netherlands approved this study. Personal data and research data was de-identified according to European General Data Protection Regulation.

Results

Patient selection

The Safety First study included 3,630 participants. In 1,435 of the participants data on the final diagnosis was missing and these patients were excluded from the analysis. See flowchart. Among the remaining 2,195 patients, in 1,148 (52.3%) the supervising GP was involved.

Figure 1: Flowchart of study population



Abbreviations: OHS-PC: out-of-hour service primary care, GP: general practitioner, n: amount of triage conversations, ACS: acute coronary syndrome

Baseline characteristics

In Table 2, the baseline characteristics are presented of the 2,195 patients divided into those in whom the GP was consulted and those in whom not. The mean age of the whole population was 59.1 (SD 19.5) years and 44.4% were male. In the 'consulted group', the duration of phone calls was longer than in the 'not consulted group' (8:43 (SD 4:08) vs. 6:19 (SD 2:56) minutes, p<0.001). Nearly all patients mentioned chest pain in both groups (93.5% vs. 93.7%, p=0.830). A history of hypertension (39.7% vs 32.0%, p=0.016) and hypercholesterolemia (30.2% vs 20.5%, p=0.001) was more often registered in the 'consulted group' as was sympathetic nervous system related symptoms (49.3% vs 40.3%, p=0.019) and calling within 12 hours of symptom onset (75.9% vs 70.0%, p=0.003).

Table 2: Baseline characteristics of patients with symptoms suggestive for ACS, divided in those with and without consultation of the supervising GP.

Characteristics	Total n (%)	Consultation of the supervising GP n (%)	No consultation of the supervising GP n (%)	P-value
Total n=2195	2195 (100)	1148 (52.2)	1047 (47.7)	
Mean age in years (SD)	59.1 (19.5)	59.5 (19.0)	58.7 (20.1)	0.381
Male sex, n=2195	980 (44.4)	524 (45.6)	456 (43.6)	0.325
Phone call				
Mean duration phone call (min:sec, SD)	7:34 (3:48)	8:43 (4:08)	6:19 (2:56)	<0.001
Mean duration introduction of phone call (min:sec, SD)	0:19 (0.13)	0:20 (0:14)	0:19 (0:12)	0.038
Medical history				
Any cardiac disease n=1847	1195 (64.7)	649 (65.8)	546 (63.4)	0.280
Cardiovascular disease or risk factor* n=2195	808 (36.8)	451 (39.3)	357 (34.1)	0.012
Coronary artery disease n=1153	343 (29.7)	192 (31.2)	150 (27.9)	0.444
Hypertension n=894	323 (36.1)	191 (39.7)	132 (32.0)	0.016
Hypercholesterolemia n= 825	212 (25.7)	134 (30.2)	78 (20.5)	0.001
Diabetes n=905	180 (19.9)	98 (20.5)	82 (19.2)	0.602
Current smoking n=189	69 (36.5)	46 (34.6)	23 (41.1)	0.549
Family history of CVD n=293	212 (72.4)	129 (69.0)	83 (78.3)	0.343
History of hyperventilation or anxiety disorder n=124	85 (68.5)	55 (67.1)	30 (71.4)	0.621
Use of CV medication n=1618	856 (52.9)	486 (54.9)	370 (50.5)	0.084
Symptoms				
Chest pain n=2118	1982 (93.6)	1045 (93.5)	937 (93.7)	0.830
Shortness of breath n=1699	1096 (64.5)	574 (62.8)	522 (66.5)	0.112
SNS-related symptoms* n= 2195	1030 (46.9)	566 (49.3)	464 (44.3)	0.019
Palpitations n=353	285 (80.7)	161 (77.4)	124 (85.5)	0.057
Tingling sensations n= 264	218 (82.6)	129 (78.8)	89 (85.4)	0.774
Pain onset <12 hours n=1919	1404 (73.2)	782 (75.9)	622 (70.0)	0.003
Pain duration >15 minutes n=1837	1763 (96.0)	941 (95.3)	822 (96.7)	0.137
Radiation of pain n=1676	1077 (64.3)	593 (65.1)	484 (63.3)	0.437
Chest pain in rest n=2003	1957 (97.7)	1024 (97.4)	933 (98%)	0.392
Chest pain with to breathing n=422	317 (75.0)	155 (72.4)	162 (77.9)	0.195
Localized chest pain n=124	77 (62.1)	38 (57.6)	39 (67.2)	0.268
Patient recognized symptoms n=916	549 (59.9)	305 (38.7)	244 (61.6)	0.731

*History of coronary artery disease, hypertension, hypercholesterolemia, diabetes
**Nausea/vomiting, sweating, pallor/ashen skin

In total, 251 patients were diagnosed with ACS (47% in those 'consulted' and 53% in those 'not consulted'). Baseline characteristics for those with ACS are presented in Table 3, subdivided in those 'consulted' and 'not consulted'. The mean age was 69.7 (SD 13.4) years, with 3 years mean difference between both groups, and 59.8% of patients were male, with no significant difference in complaints between those 'consulted' and 'not consulted'. A history of cardiac disease (79.6% vs 68.7%) and cardiovascular risk factors (hypertension 60.8% vs 36.1%, hypercholesterolemia 46.8% vs 25.7%, diabetes 40.4% vs 19.9%) were more often seen in patients with ACS compared to the total study population.

Table 3: Baseline characteristics for patients with diagnosis of ACS, divided in with and without involvement of the supervising GP.

Characteristics	Total n (%)	Consultation of supervising GP n (%)	No consultation of the supervising GP n (%)	P-value
Total n=251	251	118 (47.0)	133 (53.0)	
Mean age in years (SD)	69.7 (13.4)	68.1 (13.5)	71.2 (13.2)	0.068
Male sex, n=251	150 (59.8)	75 (63.6)	75 (56.4)	0.248
Phone call				
Mean duration phone call (min:sec, SD)	6:34 (3:38)	7:52 (3:42)	5:24 (3:09)	<0.001
Mean duration intro phone call (min:sec, SD)	0:15 (0:10)	0:16 (0:11)	0:15 (0:09)	0.433
Medical history				
Any cardiac disease n=221	176 (79.6)	84 (80.0)	92 (79.3)	0.899
CV disease or risk factor* n=251	143 (57.0)	72 (61.0)	71 (53.4)	0.223
Coronary artery disease n=144	77 (53.5)	41 (59.4)	36 (48.0)	0.295
Hypertension n=79	48 (60.8)	25 (69.4)	23 (53.5)	0.148
Hypercholesterolemia n=79	37 (46.8)	23 (59.0)	14 (35.0)	0.033
Diabetes n=89	36 (40.4)	18 (50.0)	18 (34.0)	0.130
Use of CV medication n= 165	119 (72.1)	60 (70.6)	59 (73.8)	0.651
Symptoms				
Chest pain n=247	233 (94.3)	108 (93.1)	125 (95.4)	0.432
Shortness of breath n=183	120 (65.6)	54 (61.4)	66 (69.5)	0.249
SNS-related symptoms** n=251	150 (59.8)	75 (63.6)	75 (56.4)	0.248
Pain onset <12 hours n=223	187 (83.9)	84 (80.0)	103 (87.3)	0.140
Pain duration >15 minutes n=210	208 (99.0)	100 (98.0)	108 (100)	0.144
Radiation of pain n=212	156 (73.6)	74 (73.3)	82 (73.9)	0.920
Chest pain in rest n=238	236 (99.2)	110 (98.2)	126 (100)	0.132
Patient recognized symptoms n=112	68 (60.7)	33 (56.9)	35 (64.8)	0.505

*History of coronary artery disease, hypertension, hypercholesterolemia, diabetes
**Nausea/vomitus, sweating, pallor/ashen skin

Relation between involvement of the supervising GP and ACS (and other LTE)

Of all patients, 251 were diagnosed with an ACS and 68 with another LTE (i.e., pulmonary embolism or aortic dissection), and the remaining 1876 patients had a non-urgent diagnosis. 118 patients in the 'consulted group' and 133 in the 'not-consulted group' had an ACS (10.3% vs. 12.7%, OR 0.79 (95% CI 0.61-1.03)). This was for ACS or other LTE 13.2% vs. 16.0%; OR 0.79 (95% CI 0.63-1.01)). Females were significantly less frequently diagnosed with an ACS/other LTE in the 'consulted' group than the non-consulted group (9% vs. 12.6%, OR 0.68 (95% CI 0.47-0.98)), but males were not (13.2% vs. 16.0%, OR 0.86 (95%CI 0.63-1.19). Correction for age did not substantially impact the results.

Table 4: Relation between involvement of the supervising GP and ACS in patients with chest discomfort

	Consultation supervising GP			
	Yes (n=1148)		No (n=1047)	
	Male (n=524)	Female (624)	Male (n=456)	Female (n=591)
ACSs (n=251)	118 (10.3%)		33 (12.7%	
	75 (14.3%)	43 (6.9%)	75 (16.4%)	58 (9.8%)
No ACS (n=1944)	1030 (89.7%)		914 (87.3%)	
	449 (85.7%)	581 (93.1%)	381 (83.6%)	533 (90.2%)

Table 5: Relation between involvement of supervising GP and ACS in patients with chest discomfort

Logistic regression	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.79 (0.61-1.03)	0.075
Supervising GP adjusted for sex	0.77 (0.59-1.01)	0.058
Supervising GP adjusted for age per year	0.76 (0.58-0.99)	0.047
Supervising GP adjusted for sex and age per year	0.75 (0.57-0.98)	0.034
Logistic regression in males	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.85 (0.60-1.20)	0.355
Supervising GP adjusted for age per year	0.83 (0.58-1.18)	0.289
Logistic regression in females	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.68 (0.45-1.03)	0.066
Supervising GP adjusted for age per year	0.65 (0.42-0.99)	0.043

Table 6: Relation between involvement of the supervising GP and ACS/other LTE in patients with chest discomfort

	Consultation supervising GP			
	Yes (n=1148)		No (n=1047)	
	Male (n=524)	Female (n=624)	Male (n=456)	Female (n=591)
ACS/LTE (n=319)	151 (13.2%)		168 (16.0%)	
	95 (18.1%)	56 (9.0%)	93 (20.4%)	75 (12.6%)
Non-urgent diagnosis (n=1876)	997 (86.8%)		879 (84.0%)	
	429 (81.9%)	568 (91.0%)	363 (79.6%)	516 (87.3%)

Table 7: Relation between involvement of the supervising GP and ACS/LTE in patients with chest discomfort

Logistic regression	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.79 (0.63-1.01)	0.055
Supervising GP adjusted for male sex	0.78 (0.61-0.99)	0.040
Supervising GP adjusted for age per year	0.76 (0.60-0.98)	0.030
Supervising GP adjusted for male sex and age per year	0.75 (0.59-0.96)	0.021
Logistic regression in males	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.86 (0.63-1.19)	0.369
Supervising GP adjusted for age per year	0.84 (0.61-1.16)	0.290
Logistic regression in females	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.68 (0.47-0.98)	0.038
Supervising GP adjusted for age per year	0.64 (0.44-0.94)	0.021

Relation between involvement of the supervising GP and urgency allocation in patients with chest discomfort

Patients in whom the supervising GP was involved were more often assigned a high urgency level compared to patients in whom the supervising GP was not involved (65.8% vs. 60.7%, OR 1.26 (95% CI 1.06-1.50)). This was significant in females (67.6% vs. 60.7%, OR 1.35 (95% CI 1.07-1.71)) but not in males (63.2% vs 59.4%, OR 1.17 (0.91-1.52)). Correction for age and sex did not affect the ORs.

Table 8: Urgency allocation of patients with and without involvement of the supervising GP in patients with chest discomfort.

	Consultation of supervising GP			
	Yes (n=1148)		No (n= 1047)	
	Male (n=524)	Female (n=624)	Male (n=456)	Female (n=591)
High urgency (n=1383)	753 (65.6%)		630 (60.2%)	
	331 (63.2%)	422 (67.6%)	271 (59.4%)	359 (60.7%)
Low urgency (n=812)	395 (34.4%)		417 (39.8%)	
	193 (36.8%)	202 (32.4%)	185 (40.6%)	232 (39.3%)

Table 9: Relation between involvement of supervising GP and urgency allocation in patients with chest discomfort

Logistic regression	**Odds ratio (95% CI)**	**P-value**
Supervising GP	1.26 (1.06-1.50)	0.009
Supervising GP adjusted for male sex	1.27 (1.06-1.51)	0.008
Supervising GP adjusted for age per year	1.26 (1.05-1.50)	0.013
Supervising GP adjusted for male sex and age per year	1.26 (1.05-1.51)	0.012
Logistic regression in males	**Odds ratio (95% CI)**	**P-value**
Supervising GP	1.17 (0.91-1.52)	0.231
Supervising GP adjusted for age per year	1.16 (0.89-1.51)	0.279
Logistic regression in females	**Odds ratio (95% CI)**	**P-value**
Supervising GP	1.35 (1.07-1.71)	0.012
Supervising GP adjusted for age per year	1.35 (1.06-1.73)	0.016

Relation between involvement of the supervising GP and urgency allocation in patients with ACS

In 78.5% of all 251 patients with a final diagnosis of ACS a high urgency was allocated. In 118 patients the supervising GP was consulted and in 133 not. In patients in whom the supervising GP was involved less often a high urgency was allocated (68.6% vs 87.2%, OR 0.32 (95% CI 0.17-0.61)). In females this relation was stronger (OR 0.24 (95% CI 0.08-0.69)) than in males (OR 0.39 (95%CI 0.17-0.87)). Adjustment for age did not affect the ORs.

Table 10: Relation between involvement of the supervising GP and urgency allocation in patients with ACS

	Consultation supervising GP			
	Yes (n=118)		No (n=133)	
	Male (n=75)	Female (n=43)	Male (n=75)	Female (n=58)
High urgency (n=197, 78.5%)	81 (68.6%)		116 (87.2%)	
	52 (69.3%)	29 (67.4%)	64 (85.3%)	52 (89.7%)
Low urgency (n=54, 21.5%)	37 (31.4%)		17 (12.8%)	
	23 (30.7%)	14 (32.6%)	11 (14.7%)	6 (10.3%)

Table 11: Relation between involvement of supervising GP and urgency allocation in patients with ACS

Logistic regression	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.32 (0.17-0.61)	0.001
Supervising GP adjusted for male sex	0.32 (0.17-0.61)	0.001
Supervising GP adjusted for age per year	0.34 (0.18-0.64)	0.001
Supervising GP adjusted for male sex and age per year	0.34 (0.18-0.64)	0.001
Logistic regression in males	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.39 (0.17-0.87)	0.022
Supervising GP adjusted for age per year	0.39 (0.17-0.87)	0.021
Logistic regression in females	**Odds ratio (95% CI)**	**P-value**
Supervising GP	0.24 (0.08-0.69)	0.008
Supervising GP adjusted for age per year	0.26 (0.09-0.78)	0.016

Overruling of the (NTS) urgency allocation in patients with ACS

In all NTS-generated low urgency cases 23.5% was overruled to a high urgency. This was similar in both the 'consulted' group and the 'not consulted' (23.9% vs 22.7%). In the 'consulted' groups the NTS-generated high urgencies were upgraded from 61.0% to 68.6% final high urgencies. In the 'not-consulted' group, the triage nurse on her/his own increased the NTS-high urgencies, from 83.5% to 87.2% final high urgencies. In the 'consulted' group the NTS-generated urgency was downgraded to low urgent in 2 cases (2.8%), these cases were downgraded from U2 to U3. In the 'not consulted' group this occurred in none of the cases. In 35 NTS-generated low urgent cases after consultation of the supervising GP no adjustment was made; 25 of them were U3 and 10 were U5. In NTS-generated low urgent cases the supervising GP was consulted more often (39.0% vs 16.5%).

Table 12: Overruling of the NTS urgency allocation in patients with ACS

Final urgency allocation	**NTS-generated urgency**	
	High (n=183)	Low (n=68)
High (n=197, 78.5%)	181 (98.9%)	16 (23.5%)
Low (n=54, 21.5%)	2 (1.1%)	52 (76.5%)

Table 13: Overruling of the NTS urgency allocation in patients with ACS in whom the GP was involved

Final urgency allocation	NTS-generated urgency	
	High (n=72, 61.0%)	Low (n=46, 39.0%)
High (n=81, 68.6%)	70 (97.2%)	11 (23.9%)
Low (n=37, 31.4%)	2 (2.8%)	35 (76.1%)

Table 14: Overruling of the NTS urgency allocation in patients with ACS in whom the GP was NOT involved

Final urgency allocation	NTS-generated urgency	
	High (n=111, 83.5%)	Low (n=22, 16.5%)
High (n=116, 87.2%)	111 (100%)	5 (22.7%)
Low (n=17, 12.8%)	0 (0.0%)	17 (77.3%)

Table 15: Overview of the NTS urgency allocation vs final urgency allocation in patients with ACS in whom the GP was involved

Final urgency allocation	NTS-generated urgency allocation				
	U1	**U2**	**U3**	**U4**	**U5**
U1	52	1	4	0	1
U2	4	13	5	0	1
U3	0	2	25	0	0
U4	0	0	0	0	0
U5	0	0	0	0	10

Discussion

Main findings

In this study among 2,195 individuals that called the OHS-PC for chest discomfort, 11.4% had an ACS and 14.5% an ACS/other LTE. In just over half (52.3%) of the patients, the GP was consulted by the triagist, while this was in 43% of those who eventually showed to have an ACS.

The 'consulted group' did not differ significantly from the not-consulted group regarding presented symptoms, but had significantly more often CAD, hypertension, hypercholesterolaemia and/or diabetes (39.3% vs 34.1%, p=0.012). The 'consulted group' had less often an ACS (10.3 vs. 12.7%, OR 0.79 (95% CI 0.61-1.03), more so in females (OR 0.68 (0.45-1.03)) than males OR 0.85 (0.60-1.20), and this was similar for ACS/other LTE.

Although, in the population in which the GP was consulted, the risk of ACS and LTE was lower, more patients with chest discomfort received a high urgency allocation compared to those in whom the supervising GP was not involved (OR 1.26 (95% CI 1.06-1.50)). This was significant in females (OR 1.35 (95% CI 1.07-1.71)). This suggests a defensive approach of GPs in consulted cases resulting in more patients not needing urgent referral. This is also illustrated by considering selectively the 251 patients who eventually showed to have an ACS; the 'consulted' group received less often a high urgency than the 'not consulted group' with ACS (OR 0.32 (95%CI 0.17-0.61), p<0.001); males OR 0.39 (95%CI 0.17-0.87), females OR 0.24 (95%CI 0.08-0.69). Interestingly however, the consulted GPs increased the NTS-generated high

urgencies from 61.0% to 68.6% in those with eventually an ACS. In the not-consulted group, the triage nurse on her/his own also increases the NTS-high urgencies, from 83.5% to 87.2% in the patients who eventually showed to have an ACS. In total, both types of over-ruling together improved the sensitivity of the NTS-high urgency allocation in patients with ACS from 72.9% to 78.5% for the final high urgency allocation (U1/U2).
In conclusion, in those who eventually show to have an ACS, both the triagist on her/his own, as well as the GP who was involved in the triage improved the sensitivity (safety) of the NTS-high urgency (U1/U2) allocation. It highlights that the NTS alone is not safe and too often generates a low urgency in those needing a high urgency (in 27.1% of those with ACS). It is also shown that triage nurses mainly consult the GP in case the NTS does not generate a high urgency in the domain chest discomfort. Likely there is something in the conversation that triggers the triage nurse that a higher urgency is needed and therefore consult the GP. To improve the NTS, it would be good to know what triggers the triage nurses.

Comparison with literature

To our best knowledge this is the first manuscript evaluating the impact of consultation of the supervising GP on urgency allocation in patients with chest discomfort in the OHS-PC setting. An interesting study is a case-control study of calamities in patients suspected of ACS. In SAE calls with missed ACS cases, the GPs were more often contacted by triagist than in controls. (17) This study also provides evidence that the less clear presentations of patients with chest comfort may cause problems for both triagist and supervising GP.
Another general practice study compared GP's clinical risk estimate with a prediction rule based on history taking and physical examination in patients with chest discomfort. They reported that GPs were more accurate in identifying patients with ACS (75% vs. 66%). (18)
Wouters et al. reported accuracy results of the NTS of a somewhat smaller number of patients of the Safety First study and thus providing similar results on this respect. (6) Importantly, they did not evaluate the impact of the supervising GP.
These previous studies, like our study, support the conclusion that both the triagist and the supervising GP improve the sensitivity (safety) of the NTS-high urgency allocation in patients with chest discomfort for both patients with an ACS or other LTE.
A systematic review by Nishi et al. reported a higher sensitivity of 70-80% for allocating a high urgency level in patients with ACS if the Manchester triage system was used in the ED setting. (19) But even with the advantage of face-to-face contact, the Manchester triage system - which is similar to the NTS- does not perform optimal in identifying patients with an ACS although the prior chance was higher in that population.

Strengths and limitations

A strength of this study is that data was included from several OHS-PC locations in the Netherlands and therefore generating results that are generalizable to the Dutch population or even to countries with a similar OHS-PC service. Another strength is that we used the original telephone triage conversations, and that researchers evaluating the calls were blinded to the final diagnosis, which reduced the risk of observer bias. Data on the final diagnosis was retrieved from the patient's own GP, including hospital letters.
A limitation is that there was some misclassification in the final urgency allocation, in that the triage nurse did not adapt the NTS-urgency while it should have been done. We therefore could have underestimated the number of over-rulings, notably in the direction of increasing the urgency. Another limitation is that in only 61.5% of all patients who called the OHS-PC the

final diagnosis was retrieved from the GP. This selection, however, likely did not result in selection bias because the 'unwillingness of GPs' to provide diagnoses seems not to be related to either urgency allocation or likeliness of ACS or ACS/LTE.

Conclusion

In half of the patients, the supervising GP was involved, and they had similar symptoms than patients in those in whom no consultation took place. These patients were diagnosed less with an ACS but received mor often a high urgency allocation. However, this discrepancy was completely driven by patients who had no ACS, more so in females. This suggests that patients in whom the GP was consulted were more difficult to triage resulting in relative over-triage of those without ACS or other LTE.

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