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Faculty of Science and Technology, Health Sciences

Master thesis

The chain of emergency care in patients with syncope complaints



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Abstract

Background: The number of patients who present syncope complaints in the chain of emergency care is unknown. Syncope complaints often lead to a diagnostic dilemma. Patients present themselves with asymptomatic complaints. In addition, the patient journey from presentation to diagnosis is often unstructured and results in the overutilization of medical resources and frequent inappropriate hospitalizations. The aim of this study was to provide insight into the different routes and outcomes of patients with syncope complaints who contacted one or more healthcare organizations in the chain of emergency care.

Methods: This retrospective observational study used data from the database Emergency Care Monitor in April 2015 and April 2016. All patients who presented themselves with syncope complaints, consisting of transient loss of consciousness (TLOC) or altered mental status (AMS), and who contacted one or more healthcare organizations in the chain of emergency care were included. The chain of emergency care consists of general practitioner cooperative (GPC), emergency medical service (EMS), emergency department (ED) and cardiac care unit (CCU). The database Emergency Care Monitor includes data on demographic variables (gender and age), date of patient contact(s), the healthcare organization(s) the patient had contact with, initial complaint(s), type of care, discharge destination and diagnosis. Descriptive statistics were used to analyze data.

Results: A total of 1300 patients were included in the study, of which 844 patients with TLOC and 456 patients with AMS. Some routes were more frequently used, e.g. GPC only or EMS only in TLOC, and ED only or EMS and ED in AMS. More than half of TLOC patients (50.7 %) and almost two thirds of AMS patients (69.3 %) were admitted to the ED or CCU. Almost half of all patients who were admitted to the ED or CCU were discharged home (48.5 % TLOC, 39.5 % AMS). The most common final diagnoses were cardiac syncope (27.2 %) and unexplained TLOC (14.2 %) in TLOC patients, and systematic organ dysfunction (30.6 %) and neurological disorder (20.6 %) in AMS patients.

Conclusions: The routes that patients used in the chain of emergency care were numerous. Admission to the ED or CCU was common and there were many different final diagnoses. Many patients were discharged home after admission to the ED or CCU, which might indicate that some patients were unnecessarily referred to the ED or CCU. Given the difficulty of determining whether patients must be referred to ED or CCU, further research should focus on the development of specific criteria and tools for risk assessment and decision-making to support healthcare organizations to make a well-established decision about referring patients to ED or CCU.

Keywords: Syncope - Chain of emergency care - Transient loss of consciousness - Altered mental status

Introduction

Syncope is defined as a form of transient loss of consciousness (TLOC) due to cerebral hypoperfusion, characterized by a rapid onset, short duration, and spontaneous complete recovery.¹ A TLOC is a frequent clinical reason for patients to visit the emergency department (ED) and is the reason for 2.9 % of all visits to the ED in the Netherlands.² The annual mortality of syncope varies from: between 18 and 33 % when there is a cardiac cause; and between 0 and 12 % when there is a non-cardiac cause.³

Syncope complaints often lead to a diagnostic dilemma. Patients present themselves with asymptomatic complaints.⁴ In addition, the underlying causes do not belong within the scope of one specialty and there are many possible diagnoses.⁵ The patient journey from presentation to diagnosis is often unstructured and results in the overutilization of medical resources and frequent inappropriate hospitalizations.⁶⁻⁸

Syncope and related disorders are often inconsistently defined in current medical literature and clinical practice.^{2,9} In Dutch clinical practice, syncope complaints are often confused with Altered Mental Status (AMS). AMS is defined as a group of clinical symptoms and includes cognitive disorders, attention disorders, unresponsiveness and decreased level of consciousness.¹⁰ Patients with AMS often show vague symptoms, which makes it difficult for emergency physicians to determine the diagnosis and treatment.

Patients who present themselves with syncope complaints can use different modes to entry the chain of emergency care, such as the general practitioner cooperative (GPC), emergency medical service (EMS), ED and coronary care unit (CCU). In the Netherlands, most patients contact the GPC during out-of-office hours. Alternatively, patients dial the national emergency number, whereby the dispatch center determines if it is necessary to send an ambulance. Another possibility is that patients directly visit the ED of the hospital. Due to the different modes of entry to the chain of emergency care and possibly the involvement of different healthcare organizations, there are different routes in the chain of emergency care.

At this moment, a national framework for quality of care and patient safety in the chain of emergency care is being developed in the Netherlands.¹¹ Patients with syncope complaints are one of the patient groups of specific interest. It is common knowledge that medical professionals recognize the importance of developing a guideline for the diagnosis and treatment of patients with syncope in the chain of emergency care.

At present, the number of patients with syncope complaints in the chain of emergency care is unknown. Healthcare organizations can provide insight into their own healthcare provision, but after referral to another healthcare organization the patient is out of sight. Therefore, it is unknown how many patients with syncope complaints contact healthcare organizations in the chain of emergency care and how many patients with syncope complaints are referred to other healthcare organizations in the chain of emergency care. Moreover, it is unknown to what extent complaints of syncope are symptoms of an actual serious life-threatening disease.

The aim of this study was to provide insight into the different routes and outcomes of patients with syncope complaints who contacted one or more healthcare organizations in the chain of emergency care.

Methods

Study design & study population

This is a retrospective observational study and used data from the database Emergency Care Monitor in April 2015 and April 2016. The Emergency Care Monitor is a registration system that collects data on the emergency healthcare demand in the Eastern Emergency Healthcare Network in the Netherlands. This region consists of 1.2 million inhabitants where five GPCs, three EMS, six EDs and six CCUs are active, which all provided data to the Emergency Care Monitor.

All patients who presented themselves with complaints of TLOC or AMS and who contacted healthcare organizations (GPC, EMS, ED or CCU) in the Eastern Emergency Healthcare Network were included. The following exclusion criteria were used: 1) healthcare organizations who could not provide the initial complaints of patients; 2) initial complaints of patients other than TLOC or AMS, defined according to the classification of the Netherlands Triage System (NTS); 3) patient complaints of TLOC or AMS initially caused by trauma; and 4) patient complaints of loss of consciousness with long duration (>5 minutes).

The initial complaint is defined as the medical complaint of the patient, as described by the healthcare professional of the first healthcare organization contacted by the patient or bystander. Healthcare organizations who could not provide the initial complaints of patients were excluded because patients who presented themselves with complaints of TLOC or AMS could not be identified. This entailed exclusion of data from one GPC, one EMS, two ED and two CCUs. Patients were excluded if their TLOC or AMS was caused by a trauma, because the presence of a trauma is usually clear and do not add valuable information for elucidation of the specific cause.¹² Trauma is defined as damage inflicted on the body as the direct or indirect result of an external force, with or without disruption of structural continuity.¹³ As syncope is characterized by a loss of consciousness with short duration (<5 minutes), patients who have experienced an episode of loss of consciousness longer than 5 minutes were not enrolled in the study.

The NTS is a Dutch standard for triage in the chain of emergency care. The NTS classifies acute patient complaints into 55 coded complaints such as abdominal pain, skin complaints, TLOC and AMS. Based on the initial complaints of the patients, the healthcare provider determines the associated NTS code and associated level of urgency. Ethical approval of the medical ethics committee was not required because patients received usual care and were not subjected to certain behavior or actions.

Data collection

The Emergency Care Monitor includes data on demographic variables (gender and age), date of patient contact(s), the healthcare organization(s) the patient had contact with, initial complaint(s), type of care, discharge destination and diagnosis.

Syncope complaints are operationalized with coded NTS complaints TLOC and AMS. The initial complaints of patients who contacted the GPC were coded according to the classification of the NTS by a GPC

healthcare professional. The initial complaints of patients who contacted the EMS were described as free text notes by an EMS professional. The initial complaints of four EDs and four CCUs were coded in two different ways: two EDs and two CCUs were coded according to the classification of the NTS; whereas, two EDs and two CCUs were described as free text notes.

The initial complaints described as free text notes were converted into initial NTS complaints by a medicine student of the Radboud University. To ensure that all patients with initial complaints described as free text notes were included, these patients were also screened on synonyms of syncope: collapse, blackout, disability and vasovagal. If any of these words were present in the initial complaints of patients, these patients were considered as patients with potential TLOC or AMS. In addition, the free text notes of initial complaints of TLOC or AMS patients of the EMS, were re-encoded by a master student Health Sciences of the University of Twente, to determine whether the initial complaints contain a confirmation of TLOC or AMS. All medical reports with doubtful free text notes of initial complaints of TLOC or AMS were re-evaluated by a senior researcher of the Eastern Emergency Healthcare Network.

Type of care is defined as the provided care by the healthcare organization GPC or EMS e.g. telephone consultation or referral to ED or CCU. Discharge destination is defined as the destination after discharge at ED or CCU, e.g. admission to a department in the hospital or home environment.

Diagnosis is defined as the attributable cause established by the healthcare provider that observed the patient, after performing an anamnesis and possibly additional tests. The diagnosis of the GPC and EMS is based on the suspected diagnosis and were coded based on the international classification of primary care (ICPC). The diagnosis of the ED and CCU is based on an assessment of a medical specialist and were coded based on the diagnosis intervention combination (DIC). DIC is a code that represents the medical procedure or treatment that the patient received related to the diagnosis. All findings were based on the data from the Emergency Care Monitor.

Data analysis

Descriptive statistics were used to describe categorical and continuous variables. Categorical variables were reported as absolute values and percentages. For continuous variables averages and standard deviations (SD) were calculated. An episode of 48 hours was used to determine whether patients experienced multiple episodes of primary TLOC or AMS during the inclusion period. If the patient had contact with one healthcare organization in the chain of emergency care, the diagnosis provided by this healthcare organization is used. If the patient had contact with two or more healthcare organizations in the chain of emergency care, the diagnosis of the last contacted healthcare organization was used. All analyses were performed using SPSS 22.0 software for Windows.

Results

Screening procedure

Out of 2812 patients, 1512 patients were excluded (Figure 1). Included in the study were 844 patients with initial NTS complaint TLOC and 456 patients with initial NTS complaint AMS. Of 844 TLOC patients, almost half of the patients were men (45.0 %) and the mean age was 54.5 years (Table 1). Eight patients presented themselves twice during the inclusion period with initial TLOC complaints. Of the 456 AMS patients, more than half of the patients were men (51.8 %) and mean age was 61.4 years. Seven patients presented themselves twice during the inclusion period with initial AMS complaints.

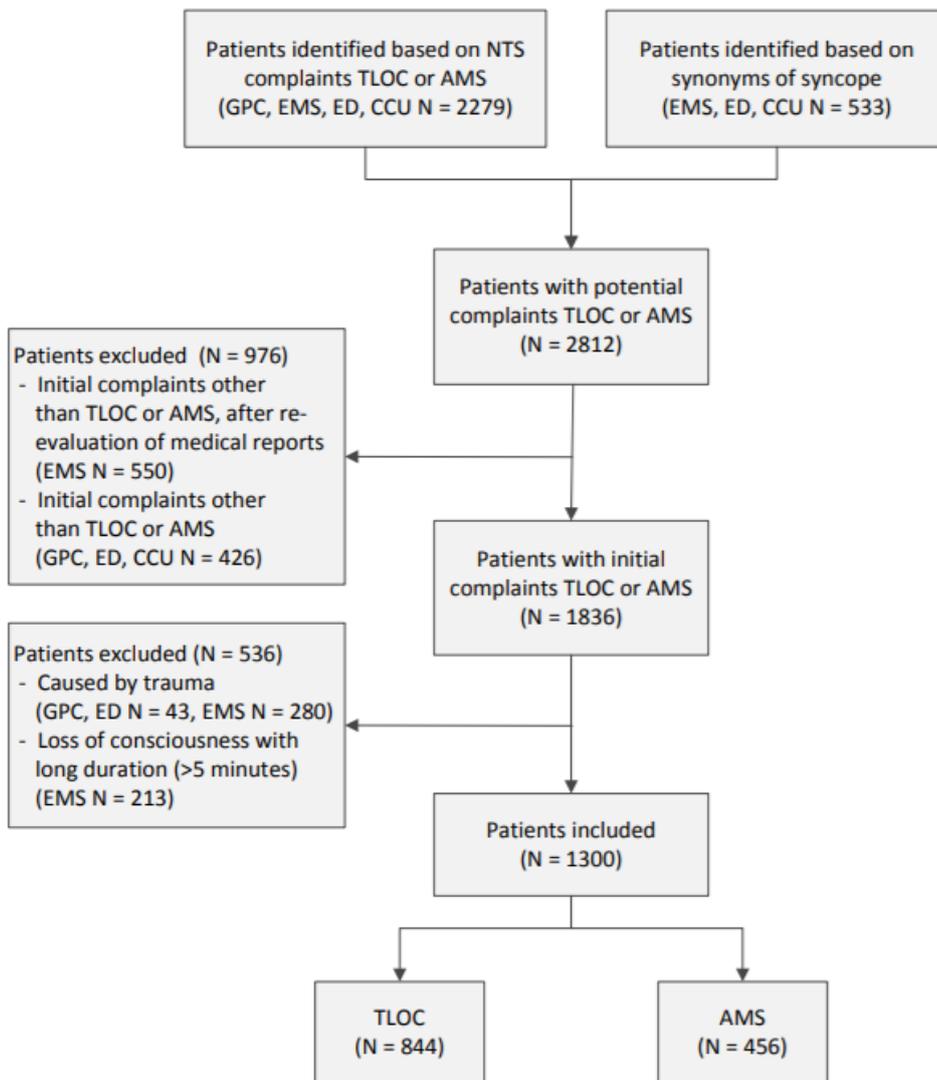


Figure 1. Flow chart in- and exclusion of patients

Table 1. Characteristics of 844 patients with TLOC and 456 patients with AMS

	TLOC (N = 844)	AMS (N = 456)
Men, N (%)	380 (45.0)	236 (51.8)
Age, mean (SD)	54.5 (25.3)	61.4 (25.4)

Different routes of patients with TLOC

The 844 patients in the TLOC group used 46 different routes in the chain of emergency care (Appendix 1). Of the 844 patients, 488 (57.8 %) had contact with one healthcare organization and 356 (42.2 %) with two or more healthcare organizations. Of the 356 patients who had contact with two or more healthcare organizations, 66 (18.5 %) had two or more contacts with the same healthcare organization. The four most frequently used routes were 'GPC only', 'EMS only', 'EMS - ED' and 'ED only' (Table 2). Of the 844 TLOC patients, 274 (32.5 %) had first medical contact with GPC, 429 (50.8 %) with EMS, 103 (12.2 %) with ED, and 38 (4.5 %) with CCU. Of the 844 TLOC patients, the EMS was involved in 461 (54.6 %) patients. The EMS transported 255 out of these 461 (55.3 %) patients to the ED or CCU. Overall, 428 out of 844 (50.7 %) patients with TLOC were admitted to ED or CCU.

Table 2. First contacted healthcare organization and most common routes of 844 patients with TLOC

First contacted healthcare organization N (%)	Routes of 844 patients with TLOC	
	Most common routes	N (%)
GPC 274 (32.5)	GPC only	199 (23.6)
	GPC - GPC	18 (2.1)
	GPC - ED	18 (2.1)
	GPC - EMS - ED	13 (1.5)
	GPC - other	26 (3.1)
EMS 429 (50.8)	EMS only	160 (19.0)
	EMS - ED	146 (17.3)
	EMS - CCU	50 (5.9)
	EMS - other	73 (8.6)
ED 103 (12.2)	ED only	92 (10.9)
	ED - other	11 (1.3)
CCU 38 (4.5)	CCU only	37 (4.4)
	CCU - other	1 (0.1)

Total number of contacts in the chain of emergency care of patients with TLOC

The 844 TLOC patients had in total 1302 contacts in the chain of emergency care (Table 3). Of the 363 GPC contacts, 43.0 % received telephone consultation, 30.3 % received consultation whereby the patient visits the GPC and 26.7 % received visit whereby the general practitioner (GP) visits the patient at home. Of the 487 EMS contacts, 54.2 % dialed the national emergency number and 41.3 % were referred to the EMS by the GP or GPC. Of the 487 EMS contacts, 61.2 % were conveyed to the ED or CCU by EMS and 35.7 % were non-conveyed to the ED or CCU by EMS. In total, the ED and CCU had 452 contacts in the chain of emergency care, whereby 50.5 % were admitted to a department in hospital and 48.5 % were discharged home.

Table 3. Total number of contacts in the chain of emergency care of 844 patients with TLOC

	Total number of contacts in the chain of emergency care (N = 1302)			
Healthcare organization N (%)	Referral to GPC	N (%)	Type of care GPC ^a	N (%)
GPC 363 (27.9)	Self-referral	363 (100.0)	Telephone consultation	153 (43.0)
			Consultation at the GPC	108 (30.3)
			Visit by the GP	95 (26.7)
EMS 487 (37.4)	Referral to EMS	N (%)	Type of care EMS	N (%)
	Contacted 112	264 (54.2)	Referral to ED/CCU	298 (61.2)
	GP/GPC	201 (41.3)	Non-conveyed to hospital	174 (35.7)
	Other	22 (4.5)	Other	15 (3.1)
ED 324 (24.9)	Referral to ED	N (%)	Discharge destination ED ^b	N (%)
	Ambulance/112	176 (54.3)	Admission to a department in hospital	177 (56.5)
	GP/GPC	101 (31.2)	Home without GP appointment	76 (24.3)
	Self-referral	25 (7.7)	Home with GP appointment	59 (18.8)
	Other	22 (6.8)	Other	1 (0.3)
CCU 128 (9.8)	Referral to CCU ^c	N (%)	Discharge destination CCU ^d	N (%)
	GP/GPC	61 (61.0)	Home	58 (68.2)
	Ambulance	17 (17.0)	Admission to a department in hospital	24 (28.2)
	Self-referral	14 (14.0)	Other	3 (3.5)
	Other	8 (8.0)		

^a 7 missing | ^b 11 missing | ^c 28 missing | ^d 43 missing

Diagnosis of patients with TLOC

The suspected diagnoses of 259 GPC patients were: 47.9 % syncope, 5.8 % psychogenic pseudosyncope, 5.8 % epileptic seizures and 35.1 % other diagnoses, such as dizziness or hyperventilation syndrome (Table 4). The final diagnoses of 419 patients, admitted to ED and CCU were: 27.2 % cardiac syncope, 14.2 % unexplained TLOC, 11.6 % epileptic seizures, 5.8 % reflex syncope and 38.0 % other diagnoses, such as multiple organ disorders or inflammations.

Table 4. Diagnosis of 844 TLOC patients based on the last contacted healthcare organization

	Diagnosis of 844 TLOC patients			
	Suspected diagnosis N (%)		Final diagnosis N (%)	
	GPC 259 (30.7)	EMS 166 (19.7) ^a	ED 299 (35.4) ^b	CCU 120 (14.2) ^c
Syncope^d	124 (47.9)	0 (0.0)	5 (1.9)	0 (0.0)
Cardiac syncope	3 (1.2)	9 (10.0)	14 (5.2)	89 (80.9)
Reflex syncope	4 (1.5)	2 (2.2)	21 (7.8)	1 (0.9)
Syncope due to OH	4 (1.5)	0 (0.0)	5 (1.9)	0 (0.0)
Psychogenic pseudosyncope	15 (5.8)	8 (8.9)	2 (0.7)	0 (0.0)
Epileptic seizures	15 (5.8)	5 (5.6)	44 (16.4)	0 (0.0)
Unexplained TLOC	3 (1.2)	0 (0.0)	47 (17.5)	7 (6.4)
Other	91 (35.1)	66 (73.3)	131 (48.7)	13 (11.8)

^a 76 missing | ^b 30 missing | ^c 10 missing | ^d there is no distinction in the etiology of syncope

Different routes of patients with AMS

The 456 patients in the AMS group used 44 different routes in the chain of emergency care (Appendix 2). Of the 456 patients, 244 (53.5 %) had contact with one healthcare organization and 212 (46.5 %) with two or more healthcare organizations. Of the 212 patients who had contact with two or more healthcare organizations, 54 (25.5 %) had two or more contacts with the same healthcare organization. The four most frequently used routes were 'ED only', 'EMS - ED', 'EMS only' and 'GPC – EMS – ED' (Table 5). Of the 456 AMS patients, 98 (21.5 %) had first medical contact with GPC, 190 (41.7 %) with EMS, 167 (36.6 %) with ED, and 1 (0.2 %) with CCU. Of the 456 AMS patients, the EMS was involved in 244 (53.5 %) patients. The EMS transported 135 out of these 244 (55.3 %) patients to the ED or CCU. Overall, 316 out of 456 (69.3 %) patients with AMS were admitted to ED or CCU.

Table 5. First contacted healthcare organization and most common routes of 456 patients with AMS

First contacted healthcare organization N (%)	Routes of 456 patients with AMS	
	Most common routes	N (%)
GPC 98 (21.5)	GPC - EMS - ED	25 (5.5)
	GPC only	23 (5.0)
	GPC - ED	10 (2.2)
	GPC - GPC	9 (2.0)
	GPC - other	31 (6.8)
EMS 190 (41.7)	EMS - ED	77 (16.9)
	EMS only	65 (14.3)
	EMS - GPC	14 (3.1)
	EMS - CCU	12 (2.6)
	EMS - other	22 (4.8)
ED 167 (36.6)	ED only	155 (34.0)
	ED - other	12 (2.6)
CCU 1 (0.2)	CCU only	1 (0.2)

Total number of contacts in the chain of emergency care of patients with AMS

The 456 AMS patients had in total 772 contacts in the chain of emergency care (Table 6). Of the 177 GPC contacts, 61.3 % received telephone consultation, 32.7 % received visit whereby the GP visits the patient at home and 6.0 % received consultation whereby the patient visits the GPC. Of the 264 EMS contacts, 55.3 % were referred to the EMS by the GP or GPC and 39.0 % dialed the national emergency number. Of the 264 EMS contacts, 59.5 % were conveyed to the ED or CCU by EMS and 37.1 % were non-conveyed to the ED or CCU by EMS. In total, the ED and CCU had 331 contacts in the chain of emergency care, whereby 59.2 % were admitted to a department in hospital and 39.5 % were discharged home.

Table 6. Total number of contacts in the chain of emergency care of 456 patients with AMS

Healthcare organization N (%)	Total number of contacts in the chain of emergency care (N = 772)			
	Referral to GPC	N (%)	Type of care GPC ^a	N (%)
GPC 177 (22.9)	Self-referral	177 (100.0)	Telephone consultation	92 (61.3)
			Visit by the GP	49 (32.7)
			Consultation at the GPC	9 (6.0)
EMS 264 (34.2)	Referral to EMS	N (%)	Type of care EMS	N (%)
	GP/GPC	146 (55.3)	Referral to ED/CCU	157 (59.5)
	Contacted 112	103 (39.0)	Non- conveyance to hospital	98 (37.1)
	Other	15 (5.7)	Other	9 (3.4)
ED 311 (40.3)	Referral to ED^b	N (%)	Discharge destination ED^c	N (%)
	GP/GPC	142 (46.1)	Admission to a department in hospital	182 (60.7)
	Ambulance/112	93 (30.2)	Home without GP appointment	92 (30.7)
	Self-referral	12 (3.9)	Home with GP appointment	23 (7.7)
	Other	61 (19.8)	Other	3 (1.0)
CCU 20 (2.6)	Referral to CCU^d	N (%)	Discharge destination CCU^e	N (%)
	GP/GPC	6 (42.9)	Home	9 (64.3)
	Ambulance	3 (21.4)	Admission to a department in hospital	4 (28.6)
	Other	5 (35.7)	Other	1 (7.1)

^a 27 missing | ^b 3 missing | ^c 11 missing | ^d 6 missing | ^e 6 missing

Diagnosis of patients with AMS

The suspected diagnoses of 69 GPC patients were: 15.9 % metabolic disorder, 13.0 % psychiatric problems, 7.2 % infectious factors and 50.7 % other diagnoses, such as fever or hyperventilation syndrome (Table 7). The final diagnoses of 309 AMS patients, admitted to ED and CCU were: 30.6 % systematic organ dysfunction, 20.6 % neurological disorder, 8.5 unexplained AMS and 30.6 % other diagnoses, such as epistaxis or dizziness.

Table 7. Diagnosis of 456 AMS patients based on the last contacted healthcare organization

	Diagnosis of 456 AMS patients			
	Suspected diagnosis N (%)		Final diagnosis N (%)	
	GPC 69 (15.1)	EMS 78 (17.1) ^a	ED 291 (63.8) ^b	CCU 18 (3.9) ^c
Neurological disorder	4 (5.8)	15 (36.6)	57 (21.6)	1 (5.9)
Cerebrovascular disease	1 (1.4)	2 (4.9)	31 (11.7)	0 (0.0)
Seizures/epilepticus status	2 (2.9)	1 (2.4)	12 (4.5)	1 (5.9)
Other	1 (1.4)	12 (29.3)	14 (5.3)	0 (0.0)
Systemic and organic dysfunction	3 (4.3)	5 (12.2)	73 (27.7)	13 (76.5)
Liver and gastrointestinal tract	0 (0)	0 (0.0)	32 (12.1)	0 (0.0)
Cardiovascular	2 (2.9)	1 (2.4)	7 (2.7)	13 (76.5)
Kidney	0 (0.0)	0 (0.0)	14 (5.3)	0 (0.0)
Blood/immune	1 (1.4)	0 (0.0)	13 (4.9)	0 (0.0)
Lung	0 (0.0)	4 (9.8)	7 (2.7)	0 (0.0)
Infectious factors	5 (7.2)	0 (0.0)	17 (6.4)	0 (0.0)
Psychiatric problems	9 (13.0)	4 (9.8)	6 (2.3)	0 (0.0)
Metabolic disorder	11 (15.9)	1 (2.4)	4 (1.5)	0 (0.0)
Unexplained AMS	2 (2.9)	0 (0.0)	23 (8.7)	1 (5.9)
Other	35 (50.7)	16 (39.0)	84 (31.8)	2 (11.8)

^a 37 missing | ^b 27 missing | ^c 1 missing

Discussion

Patients in the TLOC group used 46 different routes in the chain of emergency care, and patients in the AMS group used 44 different routes in the chain of emergency care. In half of the cases the patient visited only one healthcare organization (57.8 % TLOC, 53.5 % AMS). Most patients first contacted the EMS (50.8 % TLOC, 41.7 % AMS). Some routes were more frequently used, and the EMS was involved in more than half of the patients (54.6 % TLOC, 53.5 % AMS). Of the patients whereby the EMS was involved, more than half was transported to the ED or CCU by EMS (55.3 % TLOC, 55.3 % AMS). In total, 50.7 % of the TLOC patients and 69.3 % of the AMS patients were admitted to the ED or CCU. Almost half of the patients who were admitted at the ED or CCU were discharged home (48.5 % TLOC, 39.5 % AMS). The most common final diagnoses were cardiac syncope (27.2 %) and unexplained TLOC (14.2 %) in TLOC patients and systematic organ dysfunction (30.6 %) and neurological disorder (20.6 %) in AMS patients.

Different routes

Although patients went through the chain of emergency care in many different routes, most patients directly contacted the EMS (50.8 % TLOC, 41.7 % AMS) and less than a third contacted first the GPC (32.5 % TLOC, 21.5 % AMS). In the Netherlands, the usual care is that GPC acts as gatekeeper for the hospital during out-of-office hours, and that patients or bystanders only contact the EMS when they suspect that there is a life-threatening condition. Reasons for frequent contact with the EMS can be that patients and bystanders find it difficult to assess the seriousness of the situation.¹⁴ It is also possible that it is not clear for patients with an acute problem, who they can contact for emergency care during out-of-office hours.¹⁵⁻¹⁸ The challenge is to offer public education as a solution for this problem, so patients and bystanders know better which healthcare organization they can contact for which problem. Further research should focus whether it was necessary that most patients with syncope complaints directly contacted the EMS.

The patient with syncope complaints was visited by the GP at home in 26.7 % of TLOC patients and in 32.7 % of AMS patients. This is high compared to the average of all GPC contacts in the Eastern Emergency Healthcare Network (9.4 %),¹⁹ and the average of all GPC contacts of 120 GPCs outside this network (8.9 %).²⁰ In the Netherlands, it is customary for GPs to focus on care questions that the patient experiences as urgent. It is up to the triage nurse and GP to determine which urgency and care input is appropriate.¹⁷ When the situation is assessed as urgent but not as life-threatening, the GP can visit the patient, instead of immediately send an ambulance. The GP then assesses the situation on the spot and determines the follow-up action. Possible reasons why the GP often visits the patient can be the difficulty of determining the urgency of the situation and follow-up action, due to the asymptomatic symptoms and the many possible diagnoses of syncope. Further research should focus on exact reasons why GPC often visited the patient at home and whether these visits were necessary.

Of all EMS contacts, more than a third (35.7 % TLOC, 37.1 % AMS) were non-conveyed to the ED or CCU by EMS. This corresponds with the average of all non-conveyed EMS contacts in the Eastern Emergency Healthcare Network.²¹ There are studies which suggest that almost half of the ambulance rides are unnecessary and that many patients could be treated through primary care.^{22,23} According to medical professionals, the introduction of the GPC has led to poorer (telephone) accessibility and in a too large working area of the GPC, which may result that the EMS partially functioning as an overflow of the GPC.¹⁸ In addition, studies show that an increasing number of patients with less serious conditions often contact the EMS.^{24,25} Further research should focus on the possibilities for well-connected cooperation between the GP, GPC and EMS.

Of all ED contacts, almost half of the patients were discharged home (43.1 % TLOC, 38.3 % AMS), which corresponds with findings from other studies.^{7,26} The proportion of patients who were discharged home after ED admission is high compared with other diseases, such as acute heart failure of which 29.3 % of patients were discharged home after ED admission,²⁷ or moderate traumatic brain injury of which 18.4 % of patients were discharged home after ED admission.²⁸ This might indicate that some patients with syncope complaints were unnecessarily referred to the ED. Possible reasons for unnecessary referrals of patients to the ED may be that non-conveyance decision-making process for EMS is complex and multifactorial.²⁹ In addition, there is a limited amount of supportive tools for specific non-conveyance populations in EMS and competencies which ambulance professionals need to safely perform non-conveyance to hospital are limited described.²⁹ Further research should focus on the development of specific criteria and tools for risk assessment and decision-making to guide non-conveyance decision making. This may prevent unnecessary delay for the patient and unnecessary referrals to the ED.

A small minority of the patients was self-referral to the ED (7.7 % TLOC, 3.9 % AMS), which is low compared to the national average percentage of self-referrals to the ED (30.0 %).³⁰ In the Netherlands, it is customary not to go directly to the ED, but first to call the GPC or the national emergency number. Self-referrals that unnecessarily visit the ED increase the costs in healthcare because some of these patients could be treated through primary care.³¹ The reason for the low percentage of self-referrals in this study might be that people in this region are aware that they should not go directly to the ED, but should first contact the GPC or call the national emergency number.

The CCU is involved in 9.8 % of TLOC patients and in only 2.6 % of AMS patients. The reason for frequently involving the CCU in patients with TLOC, might be that emergency physicians are aware of the high mortality inherent in cardiac syncope. In this study, the cause of AMS complaints is more often a neurological cause or systematic and organic dysfunction than a cardiac cause, which makes it unlikely to refer patients with AMS to the CCU. Further research should focus on identifying risk factors of TLOC patients with a high risk of a cardiac syncope who benefit from a fast transport to the CCU.

Diagnosis

In this study, the most common final diagnosis was cardiac syncope (27.2 %) in TLOC patients. The proportion of patients with cardiac syncope was higher than other studies,^{32,33} perhaps because emergency physicians are aware of the high mortality inherent in cardiac syncope. This study found that only 7.1 % of the AMS patients has a cardiac cause, which is low compared with the proportion of cardiac cause in TLOC patients. Reason for this might be that the etiology of patients with TLOC differs from the etiology of patients with AMS.^{33,34} Due to the difference in etiology, patients with a TLOC will probably need a different medical procedure or treatment than patients with an AMS. To get the right patients, at the right place as quickly as possible, it is important for clinical practice to be knowledgeable about the different etiologies between TLOC and AMS patients. Further research should focus on clarifying the definition of syncope in the clinical practice.

Almost half of the suspected diagnoses of the EMS are missing (45.8 % TLOC, 47.4 % AMS). Reason for this might be that EMS personnel is not obligated to describe the suspected diagnosis. However, it appears from a research meeting with different healthcare organizations that EMS personnel are interested in comparing the suspected diagnosis of EMS personnel with the definitive diagnosis in the hospital. This makes it possible to determine afterwards whether EMS personnel have acted correctly. Due to the privacy of the patient, it is currently not permitted to provide feedback after patient contacts with exchange of patient data between the ED and EMS. Further research should focus on the possibilities of exchanging patient data between the ED and EMS.

Strengths and limitations

One of the strengths of this study is that patients contacts in the chain of emergency care were identified. This gives a complete overview of the different routes in the chain of emergency care, which, to our knowledge, has never been investigated to such an extent. The study is limited by the non-participation of GPs who provide emergency care during office hours, by the non-participation of healthcare organizations outside the Eastern Emergency Healthcare Network and by the exclusions of healthcare organizations that did not provide information on the initial complaints. Because of this, there is no insight in the medical reports of patients from these healthcare organizations. This possibly leads to an underestimation of the contacts in the chain of emergency care. Besides that, the free text notes of initial complaints of the EMS, EDs and CCUs were converted into initial NTS complaints. Given the difficulty of determining whether patients have presented themselves with syncope complaints, because of the asymptomatic symptoms of syncope and the inconsistently defined definition of syncope in current medical literature and clinical practice, it cannot be confirmed with absolute certainty that all patients with initial TLOC or AMS complaints were included. This effect was minimized by searching with synonyms of syncope in the free text notes of initial complaints and re-encoding the free text notes of initial complaints of the EMS. The free text notes of initial complaints of two EDs and two CCUs were not re-coded. These free text notes of initial complaints were described less extensively than the free text notes

of initial complaints of the EMS, making it unlikely that these initial complaints were incorrectly converted into NTS complaints. Nevertheless, potentially there is a low risk of selection bias.

Patients in this study were from four GPCs, two EMS, four EDs and four CCUs from a region where regular meetings are held to optimize the chain of emergency care. In the Netherlands, these networks exist throughout the country, where comparable guidelines are used. As a result, the results of this study are likely to be generalizable throughout the country. In other countries, the organization of the chain of emergency care may differ,³⁵ resulting in different routes and outcomes.

Conclusion

The routes that patients with syncope complaints used in the chain of emergency care were numerous. The EMS was involved in more than half of all patients, whereby more than half was transported to the ED or CCU by EMS. Admission to the ED or CCU was common. Many patients were discharged home after admission to the ED or CCU, which might indicate that some patients were unnecessarily referred to the ED or CCU. In this study, one-quarter of the patients with TLOC complaints were diagnosed with a cardiac syncope and one-fifth of the patients with AMS complaints were diagnosed with a neurologic disorder. Since the decision-making process whether patients must be referred to ED or CCU is difficult, further research should focus on the development of specific criteria and tools for risk assessment and decision-making to support healthcare organizations to make a well-established decision about referring patients to ED or CCU. This may yield possibilities to increase patient safety by preventing unnecessary referral or delays.

Abbreviations

AMS	Altered mental status
CCU	Coronary care unit
DIC	Diagnosis intervention combination
ED	Emergency department
EMS	Emergency medical service
GP	General practitioner
GPC	General practitioner cooperative
ICPC	International classification of primary care
NTS	Netherlands triage standard
SD	Standard deviation
TLOC	Transient loss of consciousness

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Appendix 1: Different routes of 844 patients with TLOC

	Different routes of TLOC patients	N (%)
1.	GPC	199 (23.6)
2.	EMS	160 (19.0)
3.	EMS - ED	146 (17.3)
4.	ED	92 (10.9)
5.	EMS - CCU	50 (5.9)
6.	CCU	37 (4.4)
7.	EMS - GPC	25 (3.0)
8.	GPC - GPC	18 (2.1)
9.	GPC - ED	18 (2.1)
10.	GPC – EMS - ED	13 (1.5)
11.	EMS - EMS - ED	11 (1.3)
12.	GPC - EMS - CCU	7 (0.8)
13.	EMS - GPC - GPC	6 (0.7)
14.	ED - CCU	6 (0.7)
15.	GPC - CCU	5 (0.6)
16.	EMS - GPC - ED	5 (0.6)
17.	EMS - EMS - CCU	4 (0.5)
18.	EMS - GPC - EMS - ED	3 (0.4)
19.	EMS - EMS	3 (0.4)
20.	EMS - ED - CCU	3 (0.4)
21.	GPC - EMS	2 (0.2)
22.	GPC - EMS - GPC	2 (0.2)
23.	GPC - EMS - ED - CCU	2 (0.2)
24.	GPC - ED - CCU	2 (0.2)
25.	EMS - CCU - GPC	2 (0.2)
26.	EMS - ED - EMS - ED	2 (0.2)
27.	ED - ED	2 (0.2)
28.	CCU - CCU	1 (0.1)
29.	GPC - GPC - EMS - CCU	1 (0.1)
30.	GPC - GPC - EMS - ED	1 (0.1)
31.	GPC - GPC - ED	1 (0.1)
32.	GPC - EMS - CCU - GPC	1 (0.1)
33.	GPC - EMS - GPC - ED	1 (0.1)
34.	GPC - EMS - ED - GPC	1 (0.1)
35.	EMS - CCU - CCU	1 (0.1)
36.	EMS - CCU - GPC - EMS - GPC - GPC - GPC	1 (0.1)
37.	EMS - CCU - GPC - ED	1 (0.1)
38.	EMS - GPC - GPC - GPC	1 (0.1)
39.	EMS - GPC - GPC - GPC - EMS - ED	1 (0.1)
40.	EMS - GPC - ED - GPC - ED	1 (0.1)
41.	EMS - ED - GPC	1 (0.1)
42.	EMS - ED - EMS	1 (0.1)
43.	EMS - ED - ED	1 (0.1)
44.	ED - CCU - GPC	1 (0.1)
45.	ED - CCU - EMS - CCU	1 (0.1)
46.	ED - GPC	1 (0.1)
	Total	844 (100.0)

Appendix 2: Different routes of 456 patients with AMS

	Different routes of AMS patients	N (%)
1.	ED	155 (34.0)
2.	EMS - ED	77 (16.9)
3.	EMS	65 (14.3)
4.	GPC - EMS - ED	25 (5.5)
5.	GPC	23 (5.0)
6.	EMS - GPC	14 (3.1)
7.	EMS - CCU	12 (2.6)
8.	GPC - ED	10 (2.2)
9.	GPC - GPC	9 (2.0)
10.	GPC - EMS	9 (2.0)
11.	EMS - EMS - ED	7 (1.5)
12.	GPC - EMS - GPC	6 (1.3)
13.	ED - ED	5 (1.1)
14.	ED - GPC	3 (0.7)
15.	GPC - GPC - GPC	2 (0.4)
16.	GPC - EMS - GPC - GPC	2 (0.4)
17.	GPC - EMS - GPC - GPC - GPC	2 (0.4)
18.	GPC - EMS - GPC - EMS - ED	2 (0.4)
19.	EMS - EMS	2 (0.4)
20.	ED - CCU	2 (0.4)
21.	CCU	1 (0.2)
22.	GPC - GPC - GPC - GPC	1 (0.2)
23.	GPC - GPC - GPC - EMS - GPC - GPC	1 (0.2)
24.	GPC - EMS - CCU	1 (0.2)
25.	GPC - EMS - GPC - GPC - EMS - ED	1 (0.2)
26.	GPC - EMS - GPC - EMS - GPC	1 (0.2)
27.	GPC - EMS - GPC - ED	1 (0.2)
28.	GPC - EMS - ED - GPC - EMS - ED	1 (0.2)
29.	GPC - EMS - ED - ED	1 (0.2)
30.	EMS - CCU	1 (0.2)
31.	EMS - GPC - GPC	1 (0.2)
32.	EMS - GPC - GPC - GPC - GPC - GPC - GPC	1 (0.2)
33.	EMS - GPC - EMS	1 (0.2)
34.	EMS - GPC - EMS - ED	1 (0.2)
35.	EMS - GPC - ED	1 (0.2)
36.	EMS - GPC - ED - GPC	1 (0.2)
37.	EMS - EMS - GPC - GPC - EMS - GPC - ED	1 (0.2)
38.	EMS - ED - CCU	1 (0.2)
39.	EMS - ED - GPC	1 (0.2)
40.	EMS - ED - EMS	1 (0.2)
41.	EMS - ED - EMS - ED	1 (0.2)
42.	EMS - ED - ED	1 (0.2)
43.	ED - CCU - GPC	1 (0.2)
44.	ED - EMS - ED	1 (0.2)
	Total	456 (100.0)