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### ABSTRACTS – DEL 1

25

PROSPECTIVE VALIDATION OF QUICK SEQUENTIAL ORGAN FAILURE ASSESSMENT (qSOFA) FOR MORTALITY AMONG PATIENTS WITH INFECTION ADMITTED TO AN EMERGENCY DEPARTMENT	26
ATRIAL FIBRILLATION AND INFECTION AMONG ACUTE PATIENTS IN THE EMERGENCY DEPARTMENT: A MULTICENTRE COHORT STUDY OF ONE-YEAR STROKE RISK	27
FEASIBILITY AND ACCEPTABILITY OF REMOTE REAL-TIME ULTRASOUND SUPERVISION	28
EMERGENCY DEPARTMENT PERSONNEL'S INDIVIDUAL PREFERENCES SHOULD NOT BE NEGLECTED WHEN AN IT-TECHNOLOGY IS TO BE INTRODUCED	29
AWARENESS DURING CPR ON CARDIAC ARREST DUE TO AORTIC DISSECTION	30
NEW-ONSET ATRIAL FIBRILLATION IS ASSOCIATED WITH 28-DAY MORTALITY AMONG PATIENTS WITH SEPSIS	31
TRIAGE RESPONSE BY TWO DIFFERENT OUT-OF-HOURS HEALTHCARE SERVICES: AN OBSERVATIONAL COHORT STUDY	32
CAN FOLLOW-UP BY THE ACUTE TEAM CONTRIBUTE TO REDUCE THE NUMBER OF HOSPITALIZATIONS BASED ON PREVENTABLE DIAGNOSES?	33
THE NECESSITY OF PREHOSPITAL PERIPHERAL INTRAVENOUS CANNULATION AND ITS RELATION TO TRIAGE CATEGORY	34
SCHEDULED CARE – AS A WAY OF CARING. A PHENOMENOLOGICAL STUDY OF BEING CARED FOR WHEN SUFFERING FROM ALCOHOL USE DISORDERS	35
HELP ME BREATHE, PLEASE	36
INTER-RATER RELIABILITY OF TWO PAEDIATRIC EARLY WARNING SCORE TOOLS	37
PEDIATRIC EARLY WARNING SCORE SYSTEMS, NURSE'S PERSPECTIVE – A FOCUS GROUP STUDY	38
EARLY SEPSIS DETECTION WITH DEEP LEARNING ON EHR EVENT SEQUENCES	39

### ABSTRACTS – DEL 2

40

PREHOSPITAL DYSPNOEA PATIENTS IN THE NORTH DENMARK REGION	41
CHARACTERISTICS OF CITIZENS WITH REPEATED CALLS WITHIN 48 HOURS TO THE MEDICAL HELPLINE 1813	42
CLINICAL AND ENVIRONMENTAL FACTORS ARE NOT ASSOCIATED WITH ESTABLISHMENT OF PRE-HOSPITAL INTRAVENOUS ACCESS	43
CLINICAL PRESENTATION OF PULMONARY EMBOLISM AMONG PATIENTS IN THE EMERGENCY DEPARTMENT	44
COMPARISON BETWEEN FRAILTY PHENOTYPE AND DEFICIT ACCUMULATION – ASSOCIATION WITH POST-DISCHARGE 90-DAY MORTALITY	45

EVALUATION OF DISPATCH OUTCOMES AND STAFFING OF THE COPENHAGEN MOBILE HEALTH AND SOCIAL CARE UNIT – SOCIOLANCEN	46
IS VIDEO COMMUNICATION TECHNOLOGY BUILDING BRIDGES BETWEEN THE PRIMARY HEALTH CARE AND THE EMERGENCY DEPARTMENT IN THE REGION OF SOUTHERN DENMARK?	47
TRIGGER TEAM ACTIVATION FOR ACUTE PATIENTS IN A LEVEL 1 EMERGENCY HOSPITAL	48
REGISTRATION OF PREHOSPITAL VITAL PARAMETERS	49
EARLY DETECTION OF DELIRIUM – USING THE CAM SCORE	50
FRAILITY AND MORTALITY: BRADEN SCALE IS ASSOCIATED WITH MORTALITY AMONG ELDERLY, INFECTED PATIENTS ADMITTED TO AN EMERGENCY DEPARTMENT	51
CHARACTERISTIC AND HELP-SEEKING BEHAVIOR OF PATIENTS WITH INFECTIONS WHO CALLED THE MEDICAL HELPLINE 1813: A MIXED METHODS STUDY	52
HYGIENE PERCEPTION AND MOTIVATIONAL FACTORS OF INFLUENCE ON HIGH-QUALITY HAND HYGIENE PERFORMANCE AMONG EMERGENCY MEDICAL SERVICE PROVIDERS: RESULTS FROM AN INTERNATIONAL SURVEY	53
PREHOSPITAL INFECTION CONTROL AND PREVENTION IN DENMARK: A NATIONWIDE CROSS-SECTIONAL STUDY ON GUIDELINE ADHERENCE AND MICROBIAL CONTAMINATION OF SURFACES	54

# Danish Emergency Medicine Conference 8

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Abstracts – del 1

## Prospective validation of quick Sequential Organ Failure Assessment (qSOFA) for mortality among patients with infection admitted to an emergency department

2019 Vol. 2  
DEMC8 abstracts

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**Background:** Only few prospective studies have evaluated the new quick Sequential (Sepsis-Related) Organ Failure Assessment (qSOFA) score in emergency department (ED) settings. The aim of this study was to determine the prognostic value of qSOFA compared to systemic inflammatory response syndrome (SIRS) in predicting 28-day mortality of infected patients admitted to an ED.

**Methods:** A prospective observational cohort study of all adult ( $\geq 18$  years) infected patients admitted to the ED of Slagelse Hospital during 01.10.2017 to 31.03.2018. All patients with suspected or documented infection on arrival to the ED, and treated with antibiotics, were included. Admission variables included in the SIRS- and qSOFA criteria were prospectively obtained from triage forms. Information regarding 28-day mortality was obtained from the Danish Civil Registration System. The diagnostic performance of qSOFA and SIRS score for predicting 28-day mortality was assessed by analyses of sensitivity, specificity, positive predictive value (PPV), negative

predictive value (NPV), and area under the receiver operating curve (AUC) with 95% confidence intervals (CI).

**Results:** A total of 2,168 patients (47.42% male) were included. A total of 181 (8.35%) met at least two qSOFA criteria, and 1,046 (48.25%) met at least two SIRS criteria on admission. The overall 28-day mortality was 7.47% (95% CI 6.40-8.66%). Unadjusted odds ratio of qSOFA and SIRS for 28-day mortality was 2.93 (95% CI 1.92-4.47) vs 1.27 (95% CI 0.92-1.74), respectively. A qSOFA score of at least two for predicting 28-day mortality had a sensitivity of 19.10% (95% CI 13.40-26.00%), a specificity of 92.50% (95% CI 91.30-93.60%), a PPV and NPV of 17.10% (95% CI 11.90-23.40%) and 93.40% (95% CI 92.20-94.50%), respectively. A SIRS score of at least two for predicting 28-day mortality had a sensitivity of 53.70 (95% CI 45.70-61.60%), a specificity of 52.20% (95% CI 50.00-54.40%), a PPV and NPV of 8.32% (95% CI 6.72-10.20%) and 93.30% (95% CI 91.70-94.70%), respectively. The AUC for qSOFA and SIRS was 0.56 (95% CI 0.53-0.59) vs 0.53 (95% CI 0.49-0.57).

**Conclusion:** Use of qSOFA had improved specificity, but with poor sensitivity, in predicting in 28-day mortality. qSOFA and SIRS showed similar discrimination potential for mortality.

## Atrial fibrillation and infection among acute patients in the Emergency Department: a multicentre cohort study of one-year stroke risk

2019 Vol. 2  
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**Background:** Patients with infection presenting with new-onset atrial fibrillation (AF) are frequent in emergency departments (ED). Also, this combination could be associated to increased risk of stroke, and some patients might therefore benefit from thromboprophylaxis. Our aim was to describe the prognosis for concomitant infection and new-onset AF at ED arrival.

**Methods:** Cohort study of patients presenting in one

of four Danish or Swedish EDs. Odense University Hospital and Hospital of South West Jutland, Denmark, from March 13<sup>th</sup> of 2013 - April 30<sup>th</sup> of 2014 or the ED at Skåne University Hospital and the ED at Helsingborg Hospital, Sweden, from January 1 2010 - December 31 2014. AF was identified by electronic ECG records and, manually validated with high agreement (kappa 0.86 (95% CI, 0.782 - 0.947), positive predictive value 95% (95% CI, 81.8 - 99.3)).

Infection was identified using discharge diagnosis. Patients were followed from hospital admission until a diagnosis of ischemic stroke, death or 365 days after ED contact, whichever came first. Primary outcome was 1-year stroke risk for patients with infection and new-onset AF, and for patients with infection and preexisting AF, compared to patients with infection without AF. Outcomes were calculated as hazard ratios (HR). **Results:** Some 111,448 patients (median age 64, 49.5 % male) were included and 13,949 (12.5%) had an infection. Of these 1,078 (7.7%) had new-onset AF and 884 (6.3%) had preexisting AF (474 (53.6%) was not in a current oral anticoagulation therapy (OAC)). One-year stroke risk, after adjusting for sex and age, was 1.1 (95%CI, 0.7 – 1.7) in patients with infection and new-onset AF. Patients with infection and preexisting AF not receiving OAC had an adjusted one-year stroke risk of 2.1 (95%CI, 1.4 – 3.2) and patients receiving OAC it was 1.6 (95%CI, 1.0 – 2.5), compared to patients with infection but no AF. **Conclusion:** ED patients with infection and new-onset AF had a similar 1-year stroke risk as patients with infection and no AF. Patients with infection and preexisting AF show an increased 1-year stroke risk with or without OAC therapy.

## Feasibility and acceptability of remote real-time ultrasound supervision

2019 Vol. 2  
DEMC8 abstracts

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performance, and explored users' acceptability of supervision via tele-US. A tele-US setup was established and temporarily implemented in the emergency department of the Regional Hospital West Jutland in the Central Denmark Region. We intended to expose 10 junior doctors to five tele-supervised lung and cardiac POCUS examinations. Qualitatively, exposed doctors' and supervisors' acceptability were unfolded by exploratory semi-structured interviews addressing their impression, satisfaction and perceived benefits. Technical performance was assessed quantitatively by the

**Background:** Minor emergency departments (ED) struggle to access sufficient expertise to supervise learners of lung and cardiac point-of-care ultrasound (POCUS). Using tele-ultrasound (tele-US) for remote supervision may remedy this situation. We aimed to evaluate the feasibility of real-time supervision via tele-US when applied to an everyday ED clinic.

**Methods:** We conducted a mixed-methods study that assessed practical feasibility, determined

ratio in mean grey value (MGV) between images on site and as received by the supervisor, and by after-compression frame rate; MGV and frame rate were measured on five different days with alternating on-site laptops, software and internet connection.

**Results:** Remote supervision via tele-US was performed with 10 junior doctors scanning 45 included patients. Qualitatively, 12 exploratory semi-structured interviews were conducted with exposed junior doctors and supervisors. Supervisors stressed the importance of preserving frame rate, and junior doctors emphasized a need for shared ultrasound terminology. Overall, setup mobility, accessibility, and time consumption were emphasized as being of key importance for future clinical implementations. During performance assessment, neither alternating internet connection nor software significantly changed the mean grey value ratio. The lowest median frame rate of 4.6 (interquartile range [IQR]: 3.1–5.0) was found by using a 4G internet connection; the highest of 28.5 (IQR: 28.5–29.0) was found with alternative computer and local area network internet connection.

**Conclusions:** Remote supervision via a commercially available and low-cost tele-US setup is operational for both junior doctors and supervisors when applied to lung and cardiac POCUS scans of hospitalized patients.

## Emergency department personnel's individual preferences should not be neglected when an IT-technology is to be introduced

2019 Vol. 2  
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**Background:** There is an increasing demand and importance for quick clinical assessment of patients by experienced front-line physician, and for efficient patientflow in emergency department without delay. That requires application of new technologies, including IT-solutions. From the other side, healthpersonnel, as a human factor applying technology, should accept it and not be neglected. Purpose: preliminary qualitative assessment of physicians' individual preferences related to introduction of conceptual tablet-device based documentation technology in emergency department.

**Methods:** We used "Presurvey" solution developed for the emergency department in order to speed-up documentation process by front-line physicians, which is mobile device based web-app system allowing data input via button selection and visualising standardised autotext (front-line doctor's clinical assessment note) based on the ABCDE clinical algorithm. Author had participated in the concept development. "Presurvey" was used at Emergency department, Regional Hospital Horsens, during 100-days period, from October 2017, working days, between 7.30-18.00. Mini-iPad was used as mobile device. "Presurvey" was introduced to

doctors individually. 9 experienced emergency doctors were invited, they were completely free to apply the concept or not on a case to case basis. There was gathered feedback and undertaken audit.

**Results:** "Presurvey" was applied by 8 (89%) doctors in 528 patient-cases (12,5%) out of 4.215 admitted patients of medical and surgical profiles. 1 (11%) physician wouldn't use "Presurvey", 3 (33%) doctors have tried, but preferred the conventional documentation way. 5 (55%) users, including author, had positive attitude. 4 (44%) of them (without author) were active users, based on criteria of repeated use of "Presurvey". Audit revealed personal preferences, mostly addressed to autotext. The concept was evaluated as making sense by 7 (78%) doctors, however there was different level of unsatisfaction related to the text formulations. 4 (50%) participating doctors accepted autotext concept with minor adjustments, while the other 50% would prefer flexibility of "alive" language as communication tool for documentation.

**Conclusions:** Small-population observational study demonstrates that for implementation of a new IT-based technology related to the medical documentation in emergency department it is important to consider as choice flexibility for specialists as their individual variables and preferences, which should be carefully studied when introduced bigger scale solutions.

## Awareness during CPR on cardiac arrest due to aortic dissection

2019 Vol. 2  
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**Background:** Awareness during CPR is formerly reported in the literature but only in rare cases and it is still not clear whether these cases have anything in common.

in pH to 7,11 and lactate of 18 after 90 minutes all other markers remain within the normal range, and both the arterial and peripheral hemoglobin saturation remains 100%. The level of awareness does not decrease notably during the 90 minutes. Echocardiography shows a heart with no noticeable ultrasonic movement. A projection visualizing the aortic arch raises suspicion of an aortic dissection. The autopsy shows he has have suffered a complete aortic dissection

**Method:** A case report regarding a 69-year old male patient.

**Results:** The patient was admitted to the hospital due to 3 days dyspeptic symptoms and sudden onset of dyspnoea a few hours before arriva. During admission a short period of tachycardia (250/min) is followed by asystolic cardiac arrest. CPR is immediately initiated. By the arrival of the cardio-resuscitation-team, the patient has a peripheral hemoglobin saturation of 100% and a high level of awareness with open eyes and movement of the head and both arms and legs. Re-evaluation of the hearts rhythm after 3 minutes still shows asystoli. A total of 10 mg of Epinephrine is administered in boluses of 1 mg every 3-5 minutes. By the 3ed hand-off for rhythm evaluation, the patient is orally intubated. A total of 5 arterial gas samples are done during the 90 minute CPR, and despite a decrease

**Conclusion:** High level of awareness plus saturation and arterial gas almost within the normal range through all 90 minutes indicate very effective chest compressions and peripheral and cerebral blood flow. Even though the patient had a poor prognosis (complete aortic dissection and refractory asystole), termination of CPR raised ethical questions in the team as the patient was still conscious once the resuscitation was terminated by 90 minutes. Awareness during CPR also raises the question of proper sedation doing resuscitation, which is currently not part of the guidelines. Further research regarding pain relief during CPR as well as increased focus on communicative and ethical aspects during CPR is needed.



## New-onset atrial fibrillation is associated with 28-day mortality among patients with sepsis

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However, adult patients with suspected infection can be identified as being more likely to have poor outcomes typical of sepsis if they have at least two qSOFA criteria. We have analyzed the occurrence of NO-AF on admission and 28-day mortality among infected patients with two or more qSOFA criteria on admission.

**Methods:** A prospective cohort study of infected patients aged 18 years or older admitted to the emergency department (ED) of Slagelse Hospital during 01.10.2017 – 31.03.2018 (171 days). The population in the area was 198.000. All patients with suspected or documented infection on arrival, and treated with antibiotics, were included. NO-AF was defined as episodes of atrial fibrillation (AF) within 4

**Background:** New-onset atrial fibrillation (NO-AF) has been associated with adverse outcomes in sepsis. The definition of sepsis is based on organ dysfunction by use of the Sequential Organ Failure Assessment (SOFA) score.

hours from admission documented on a 12-lead electrocardiogram and without a history of prior AF. We used a logistic regression analysis to adjust for the potential confounding of the association between NO-AF and 28-day mortality. Survival status was obtained from the Danish Civil Registration System.

**Results:** A total of 2.168 infected patients with median age of 73.1 years were included, and 181 (8.3%; 95% CI 4.7-13.3) fulfilled at least two qSOFA criteria on admission. The incidence of sepsis based on qSOFA criteria was estimated to 194/100,000. A total of 15 (8.3%, 95% CI 4.7-13.3) qSOFA patients developed NO-AF. The 28-day mortality among all qSOFA patients was 17.1% (95% CI 11.9-23.4), 40.0% (95% CI 16.3-67.7) among patients with NO-AF and 15.1% (95% CI 10.0-21.4) among patients without NO-AF. Unadjusted odds ratio for 28-day mortality among NO-AF patients was 3.8 (95% CI 1.2-11.50) and 4.6 (95% CI 1.4-15.3) after adjustment for several potential confounders.

**Conclusion:** New-onset atrial fibrillation is independently associated with 28-day mortality among patients with qSOFA defined sepsis.

## Triage response by two different out-of-hours healthcare services: an observational cohort study

2019 Vol. 2  
DEMC8 abstracts

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staffed by nurses and physicians. Nationally, access to out-of-hours healthcare and emergency departments requires referral by one of the healthcare services. The OOH services in the North Denmark Region and Copenhagen handle similar patients and health problems; however, no published research has compared the type of actions performed in response to patient calls. We investigated and compared the type of triage response given by OOH-GP and OOH-1813 to patient contacts in the study period and the proportion of subsequent hospitalization.

**Methods:** Observational cohort study of patients contacting OOH-GP and OOH-1813 from January

**Background:** The entry points to Danish acute care are the out-of-hours health care services (OOH) and emergency medical services (EMS). Where EMS is organized in a similar manner throughout Denmark, the OOH is not. Four regions (including the North Denmark Region) have a general practitioner operated service (OOH-GP), whereas the Capital Region of Copenhagen, (Copenhagen) Denmark has the Medical Helpline 1813, (OOH-1813) which is

24th to February 9th, 2017. Patients with valid personal identification numbers were included. Primary outcomes were action performed by the call-handler i.e. telephone consultation, face-to-face consultation, home visit and hospitalization within 24 hours. Hospitalization was defined as a hospital stay of  $\geq 24$  hours.

**Results:** We included 32,489 contacts (OOH-GP: 21,149 and OOH-1813: 11,340 (representative sample)). Calls to the OOH-GP were handled as follows: 67.2% ( $n=14,214$ ) telephone consultation only, 32.8% ( $n=6,935$ ) face-to-face consultations including 1,089 home visits (5.1%). In comparison, at OOH-1813, 51% ( $n=5,763$ ) were handled by telephone consultation only, 49% ( $n=5,575$ ) were triaged to face-to-face consultation including 38 home visits (0.44%). The differences in triage were statistically significant ( $p<0.05$ ). Subsequent admissions occurred after 524 (4.6%) OOH-1813 contacts and 798 (3.8%) OOH-GP contacts (OR = 1.22 (1.01;1.27)).

**Conclusions:** This comparison of OOH-1813 and OOH-GP shows significant differences in the triage responses, among these, notably more face-to-face consultations at OOH-1813. Subsequent hospitalizations were comparable with a small, but statistically significant, overrepresentation among the OOH-1813 cohort. These results could be due to the differences in organizational structure of the OOH or demographics in the two regions (capital vs city-rural), however further research is needed to determine this.

## Can follow-up by the Acute Team contribute to reduce the number of hospitalizations based on preventable diagnoses?

2019 Vol. 2  
DEMC8 abstracts

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contributes to early intervention and thus reduces the number of hospitalizations based on preventable diagnoses in the municipality of Aarhus, Denmark, we found that citizens were hospitalized even after this intervention. Our hypothesis was that a systematic follow-up of all emergency examination visits provided by the Acute Team could reduce the number of hospitalizations based on preventable diagnoses.

**Methods:** A systematic follow-up of all emergency examination visits provided by the Acute Team from January 2018 to March 2018 was initiated by telephone interviews or follow-up visits. Subsequently, a comparative study was made based on reviews of the citizens' health care records. In this study records from January 2017 to March 2017, where no follow-up was initiated, were compared with records from the follow-up period. The citizens' health care records were reviewed to

**Background:** In 2017, 2829 hospitalizations were based on preventable diagnoses in the municipality of Aarhus, Denmark. Even though the Acute Team provides emergency examination visits and hereby

find out whether the citizens were hospitalized within 7 days after the emergency examination visits or not, and if the hospitalization was based on a preventable diagnosis. In this process the definition of preventable diagnoses made by the National Board of Health, Denmark, was used [1].

**Results:** 294 emergency examination visits were made from January 2017 to March 2017. Of these, 30 led to hospitalizations based on preventable diagnoses, i.e. a hospitalization rate of 10.2%. 433 emergency examination visits were made in the period January 2018 to March 2018. Of these, 17 led to hospitalizations based on preventable diagnoses, i.e. a hospitalization rate of 3.9%. By comparing the data from 2017 and 2018 a reduction of 6.3% was found, which indicates that 27 hospitalizations were prevented.

**Conclusions:** Our findings indicate that Acute Team's systematic follow-up of emergency examination visits can contribute to reduce the number of hospitalizations based on preventable diagnoses. Such follow-up may benefit early municipal intervention by detecting early symptoms of illness.

[1] The National Board of Health, Denmark [Sundhedsstyrelsen]. Forebyggelse af u hensigtsmæssige indlæggelser – en oversigt over viden om kommunale indsatser. Sundhedsstyrelsen 21. oktober 2015.

## The necessity of prehospital peripheral intravenous cannulation and its relation to triage category

2019 Vol. 2  
DEMC8 abstracts

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**Background:** Prehospital peripheral intravenous cannulation (PPIC) is a procedure performed routinely and often precautionary despite evidence that it increases the risk of infection and phlebitis, prolongs scene time and increases

mortality. The aim of this study was to identify to which extent PPIC was necessary before arrival to hospital, and to investigate whether the triage category of the patient had a role in the necessity of PPIC.

**Methods:** Prehospital providers from the Capital Region of Denmark were asked to collect data on all PPIC attempts in a course of two months, during summer 2018. The questions were related to the patients' classification into one of four available triage categories and the providers' assessment of the necessity of the PPIC for either prehospital medical treatment or the anticipation of such. Data

was exported to statistical software for analysis and descriptive statistics was performed.

**Results:** From the available datasets (n=204) 52% (n=106) of PPIC attempts were considered necessary by the prehospital provider. In the red/immediate triage category, 37 PPIC attempts were performed, of these 70.2% (n=26) were considered necessary. In the amber/very urgent triage category, 20 PPIC attempts were performed, of these 85% (n=17) were considered necessary. In the yellow/urgent triage category, 40 PPIC attempts were performed, of these 65% (n=26) were considered necessary. In the green/non-urgent triage category, 107 PPIC attempts were performed, of these 34.6% (n=37) were considered necessary.

**Conclusions:** Based on the findings of this study, approximately half of PPIC's are necessary for prehospital use, and the necessity tends to correspond with an increase in triage category. However, PPIC necessity for patients in the green/non-urgent triage category should be carefully evaluated, based on a patient risk/benefit analysis.

## Scheduled care – as a way of caring. A phenomenological study of being cared for when suffering from alcohol use disorders

2019 Vol. 2  
DEMC8 abstracts

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patients are frequent visitors in the emergency departments. The meeting between patient and healthcare is considered contradictory and characterized by dilemmas and arbitrariness. Furthermore, this patient group differs from the regular patient. They are often characterized by very complex health pictures and chaotic social problems spawned by turbulent lifestyles. However, the experience of a hospitalization from a patient perspective is sparsely documented in a scientific context. The aim of this study was to elucidate the lived experience of how patients with alcohol use disorders experience being cared for when admitted to acute medical units.

**Method:** The data set consists of 15 in-depth interviews with patients suffering from alcohol use disorders admitted to an acute medical unit. The study is anchored in the phenomenological

**Background:** Excessive alcohol consumption is health damaging and is also recognized as one of the major avoidable health risk factors. Alcohol use disorders are classified among one of the most harmful, debilitating disease categories and

philosophy and the methodology applied is a descriptive phenomenological method as defined by Dahlberg. The intention is to identify and understand the essences, patterns, and structures of the lived experience of being cared for when hospitalized and suffering from alcohol use disorders. Data has been analysed according to the guidelines in Reflective Lifeworld Research, given by Dahlberg.

**Results:** Being cared for was experienced as a two-staged process that changed throughout the hospitalization from an experience of scheduled care experienced as caring to an experience of scheduled care experienced as non-caring. Four constituents further described the variable experiences: being in a safe haven, sharing a tacit but mutual goal, being in a chaotic space, and being on your own.

**Conclusion:** The study showed that patients suffering from alcohol use disorders call for an intentional and distinctive attentiveness from the carers throughout their hospitalization. Being both seen and met in an authentic presence by carers was a powerful tool that helped ease the hospitalization. Likewise the absence of the authentic presence during the second stage may have hindered the carers notice and respond to a transfer of attention within the patients, and thus adapting the care provided.

## Help Me Breathe, Please

2019 Vol. 2  
DEMC8 abstracts

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point for the healthcare professionals may be to ensure vacant beds. This may be at the expense of caring for the patients sufficiently due to their individual needs. Focus on the flow culture may be contrary to the need for e.g. silence, safety, continuity in care and time with the healthcare professionals.

**Background:** The aim was to gain insight into how patients with chronic obstructive pulmonary disease (COPD) experience being acutely admitted to an emergency department in Denmark. The Department is characterized by a large number of acute patients, which means that the focal

**Methods:** This study has a qualitative design with a phenomenological hermeneutic approach. The empirics consist of qualitative semi-structured interviews with fourteen patients admitted to an emergency department in Denmark. The data has been analysed through the four steps about meaning condensation and meaning interpretation as described by Kvale and Brinkmann.

**Results:** The preliminary analyses indicated that patients being admitted to the Emergency Department experience a strong need for getting help to breathe and rest. They have struggled with their breathing when they were at home and therefore feel extremely tired. Thus, the chaos that often exists in the Emergency Department may affect the patients' well-being. In addition, the healthcare professionals' way of communicating with the patients has a great impact on patient's feeling safe and comfortable.

**Conclusion:** By focusing on the patients' individual fundamental care needs in a busy department, it may qualify continuity of care for patients with COPD.

## Inter-rater reliability of two paediatric early warning score tools

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data are only as reliable and accurate as the caregivers who obtain and document the parameters. The aim of this study is to evaluate inter-rater reliability among nurses using PEWS systems.

**Method:** The study was carried out in five paediatrics departments in the Central Denmark Region. Inter-rater reliability was investigated through parallel observations.

**Background:** Paediatric early warning score (PEWS) assessment tools can assist healthcare providers in the timely detection and recognition of subtle patient condition changes signaling clinical deterioration. However, PEWS tools instrument

A total of 108 children and 69 nurses participated. Two nurses simultaneously performed a PEWS assessment on the same patient. Before the assessment, the two participating nurses drew lots to decide who would be the active observer. Intraclass correlation coefficient, Fleiss'  $\kappa$  and Bland-Altman limits of agreement were used to determine inter-rater reliability.

**Results:** The intraclass correlation coefficients for the aggregated PEWS score of the two PEWS models were 0.98 and 0.95, respectively. The  $\kappa$  value on the individual PEWS measurements ranged from 0.70 to 1.0, indicating good to very good agreement. The nurses assigned the exact same aggregated score for both PEWS models in 76% of the cases. In 98% of the PEWS assessments, the aggregated PEWS scores assigned by the nurses were equal to or below 1 point in both models.

**Conclusion:** The study showed good to very good interrater reliability in the two PEWS models used in the Central Denmark Region.

## Pediatric Early Warning Score Systems, nurse's perspective – a focus group study

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and to highlight factors facilitating and impeding the use of PEWS tools in clinical practice we aim to obtain knowledge about nurses' experiences with PEWS.

**Methods:** An exploratory qualitative design was chosen using focus group discussions to gain a deeper understanding of nurses' experiences with PEWS. A total of five focus group discussions were conducted at three hospitals, and the analyses performed were inspired by Kvale and Brinckman.

**Background:** Pediatric early warning score (PEWS) systems are used to monitor pediatric patients' vital signs and facilitate the treatment of patients at risk of deteriorating. The aim of this study was to gain knowledge about nurses' experiences with PEWS

**Results:** Seven themes were identified, including i) lack of interdisciplinary awareness, ii) clinical judgment and PEWS—a multi-faceted approach, iii) PEWS supports a professional language, iv) monitoring equipment—a challenge, v) PEWS helps to visualize the need for escalating care, vi) an inflexible and challenging tool, and vii) supportive tools enhance the nurses' experiences of PEWS positively.

**Conclusions:** Our findings suggest that attention should be given to nurses' perceptions of how both clinical judgment and PEWS should be seen as essential in providing nurses with information about the patients' conditions. If not, the risk of failing to recognize patients' deteriorating conditions will remain. From the nurses' perspective, medical doctors seemed unaware of their role in using PEWS.



## Early Sepsis Detection with Deep Learning on EHR Event Sequences

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**Methods:** We constructed predictive models for sepsis detection and performed a register-based cohort study on patients from four Danish municipalities. We used event-sequences of raw electronic health record (EHR) data from 2013 to 2017, where each event consists of three elements: a timestamp, an event category (e.g. medication code), and a value. In total, we consider 25.622 positive (SIRS criteria) sequences and 25.622 negative sequences with a total of 112 million events distributed across 64 different hospital units. The number of potential predictor variables in raw EHR data easily exceeds 10.000 and can be challenging

**Background:** Sepsis is a clinical condition involving an extreme inflammatory response to an infection, and is associated with high morbidity and mortality. Without intervention, this response can progress to septic shock, organ failure and death. Every hour that treatment is delayed mortality increases. Early identification of sepsis is therefore important for a positive outcome.

for predictive modeling due to this large volume of sparse, heterogeneous events. Traditional approaches have dealt with this complexity by curating a limited number of variables of importance; a labor-intensive process that may discard a vast majority of information. In contrast, we consider a deep learning system constructed as a combination of a convolutional neural network (CNN) and long short-term memory (LSTM) network. Importantly, our system learns representations of the key factors and interactions from the raw event sequence data itself.

**Results:** Our model predicts sepsis with an AUROC score of 0.8678, at 11 hours before actual treatment was started, outperforming all currently deployed approaches. At other prediction times, the model yields following AUROC scores. 15 min: 0.9058, 3 hours: 0.8803, 24 hours: 0.8073.

**Conclusion:** We have presented a novel approach for early detection of sepsis that has more true positives and fewer false negatives than existing alarm systems without introducing domain knowledge into the model. Importantly, the model does not require changes in the daily workflow of healthcare professionals at hospitals, as the model is based on data that is routinely captured in the EHR. This also enables real-time prediction, as healthcare professionals enters the raw events in the EHR.

# Danish Emergency Medicine Conference 8

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Abstracts – del 2

## Prehospital dyspnoea patients in the North Denmark Region

2019 Vol. 2

DEMC8 abstracts

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the main cause for a dispatched ambulance was “Breathing difficulty”, and all emergency ambulance patients who were diagnosed within the ICD-10 chapter “Diseases of the respiratory system” at hospital.

**Background:** Prehospital dyspnoea patients are a frequent group with a high mortality. However, there is limited knowledge about their characteristics. We aimed to investigate causes for dispatched ambulances to patients diagnosed with dyspnoea, and diagnoses given to patients to whom an ambulance was dispatched due to dyspnoea.

**Method:** Retrospective cohort study in the North Denmark region in the period 2012-2015. We included all emergency ambulance patients where

**Results:** 4933 patients had an ambulance dispatched due to “Breathing difficulty”. Their most frequent diagnoses at hospital were ICD-10 chapter “Diseases of the respiratory system” (49.45%), “Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified” (18.56%), “Diseases of the circulatory system” (9.20%), and “Factors influencing health status and contact with health services” (5.71%). Contrariwise, 5163 emergency ambulance patients received a diagnosis within ICD-10 chapter “Diseases of the respiratory system” at hospital. The most frequent causes for dispatched ambulances to these patients were “Breathing difficulty” (49.45%), “Unclarified problem” (11.16%), and “Chest pain - heart disease” (9.55%). 16.00% of dispatches were without cause.

**Conclusion:** Only half of the patients had both ambulance dispatch and hospital diagnose related to breathing difficulties. The variation and distribution of causes for ambulance dispatch and diagnoses given at hospital, suggests that dyspnoea is a symptom present in many conditions and the patient group is complex.

## Characteristics of citizens with repeated calls within 48 hours to the Medical helpline 1813

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representing citizens with progression in symptoms or an unmet need for help during the initial call, which potentially may lead to delay in triage to face-to-face consultation, examination and treatment. We aimed to identify differences in sociodemographic and health related characteristics between citizens performing single calls compared to citizens performing repeated calls < 48 hours.

**Methods:** The authors used data from the prospective observational Degree-of-worry study, conducted from the Medical Helpline 1813 from 18 January - 9 February 2017, including citizens performing single calls (n=11.131) and citizens performing repeated calls (n=464), defined by < 48 hours between calls. Information on callers were collected from the Medical Helpline electronic records, Statistic Denmark Registers and the National Patient Register. Self-reported characteristics as self-rated health (SRH scale 1-5)

**Background:** In the Capital Region of Denmark, the Medical helpline 1813 is integrated in the Emergency Medical Services, where citizens are triaged to receive face-to-face consultation (e.g. emergency department) or telephone consultation. Approximately 4,0 % of the calls received are repeated calls < 48 hours,

and Degree of worry concerning the actual situation (DOW on scale 1-3) were collected at the initial call. The authors performed logistic regression analyses, calculating Odds Ratio (OR) and 95% Confidence Intervals (CI).

**Results:** Seven variables were significantly associated with repeated callers: Age > 65 OR=1.58 (95% CI=1.18-2.10), immigrants OR=1.41 (95% CI=1.03-1.93), annual income in highest quartiles OR=0.69 (95% CI=0.54-0.89), high DOW OR=1.33 (95% CI=1.06-1.66), poor SRH OR=1.64 (95% CI=1.21-2.21) and > 2 comorbidities OR=1.66 (95% CI=1.26-2.19). Gender and time of call were not significantly associated with repeated callers. The significant association remained in analyses adjusted for age and gender. In the mutual adjusted analyzes the disproportions decreases.

**Conclusion:** Results identify disproportions between repeated callers and single callers in characteristics related to age, immigrants, income, comorbidities and the self-rated variables SRH and DOW. This indicates that these characteristics potentially could be determinants for a delay in a face-to-face examination and treatment for citizens performing repeated calls. However, these disproportions are decreased in the mutual adjusted analyzes, indicating that sociodemographic and health related characteristics have a reinforcing effect.

## Clinical and environmental factors are not associated with establishment of pre-hospital intravenous access

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unique pre-hospital setting clinical and environmental factors may challenge the procedure. Previous studies have investigated IV procedure time and overall success-rates with little or no attention to the impact of challenging factors. The aim of this study was to investigate clinical and environmental factors associated with the first attempt of IV access establishment.

**Methods:** Data containing information on IV procedure characteristics, patient condition and environmental factors were obtained by paramedics operating in the Capital Region of Denmark. Data was collected during three non-consecutive months in 2017 and 2018. Data was exported to IBM's Statistical Package for the Social Sciences (SPSS) for analysis. A chi-square test for independence (with Yates' Continuity Correction for 2x2 tables and likelihood ratio for expected count violations) was applied to test for association between first attempt

**Background:** Establishing intravenous (IV) access is part of the paramedic scope of practice and in critically ill patients the procedure is essential to administer fluids and/or drugs. However, in the

of IV access establishment, patient condition and environmental factors.

**Results:** A total of 259 datasets were available. Statistical analysis revealed a significant association between first attempt of IV access establishment and assessed level of difficulty ( $p=0.00$ ). No significant association was found between first attempt of IV access establishment and presence of radial pulse ( $p=0.21$ ), patient triage category ( $p=0.35$ ), size of catheter ( $p=0.80$ ), site of catheter insertion ( $p=0.11$ ), light conditions ( $p=0.26$ ) and procedure location ( $p=0.31$ ).

**Conclusion:** This study concludes that first-attempt IV access establishment was significantly associated with assessed level of difficulty, and non-significantly associated with the investigated clinical end environmental factors. Based on the findings, paramedics should reconsider IV access for patients where the procedure is considered difficult, and consider other available administration options. On the contrary, paramedics should not refrain from attempting IV access establishment based on present clinical and environmental factors thought to challenge the procedure.

## Clinical presentation of pulmonary embolism among patients in the emergency department

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**Background:** Pulmonary embolism (PE) is an important clinical entity known to cause a wide range of symptoms. Morbidity and mortality of PE are high. However, knowledge of symptomatology is sparse.

**Aim:** To elucidate the clinical presentation of emergency

department (ED) patients diagnosed with PE.

**Methods:** We carried out a cross-sectional study of adult patients attending the EDs at Odense University Hospital and Hospital of Southwest Jutland. The main symptom at presentation was prospectively registered. ED and hospital discharge diagnosis was sampled from the Danish national health registry. Patients with PE were identified based on discharge

diagnoses (ICD-10 code I26.0 or I26.9) from the ED or following hospitalization.

**Results:** Among 24,124 contacts to the EDs, 322 (1.3%) were diagnosed with PE. The main presenting symptom was respiratory distress (31%; n=101), while 26% (n=85) had symptoms suspicious of heart disease such as dyspnea of cardiac cause, chest pain and palpitation, 8% (n=27) fainting / syncope or suspected neurological disorders, 8% (n=26) pain in the lower limb, and 6% (n=18) had fever as their main symptom.

**Conclusion:** PE patients have a wide variety of symptoms and most PE patients present with other symptoms than dyspnea.

## Comparison Between Frailty Phenotype and Deficit Accumulation – Association with post-discharge 90-day mortality

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**Background:** Frailty is a clinical syndrome, which develops because of age-related decline, diseases, malnutrition and lifestyle. The syndrome leads to increased vulnerability, decline in physiological reserve and a reduced ability to resist stressors

and thus, is associated with death, nursing home admission and prolonged hospital admission. There are two major overall perspectives on frailty; frailty as a phenotype and frailty as an accumulation of deficits. Following this, two different validated screening tools exist; Fried's Phenotype (FP) and Clinical Frailty Scale (CFS). However, the screening tools have not been tested in a Scandinavian cohort. The aim of this study was to investigate the association between frailty defined by FP or CFS, respectively and 90-day mortality in a Danish cohort.

**Methods:** The study was based on the CriSTAL-study (Criteria for Screening and Triaging to Appropriate Alternative care). The cohort was defined as Danish participants age > 65 years, acutely admitted to the ED and subsequent admission longer than 24 hours at Bispebjerg Hospital (BSP), Odense University Hospital (OUH) or Hospital of Southwest Jutland (SVS), respectively. A total of

N=1030 were included, equally distributed from each hospital. Frailty was measured at admission to ED. Participants were classified as frail when scoring  $\geq 3$  by FP or  $\geq 5$  by CFS. The relative risk (RR) was calculated with a 95% confidence interval (CI) for both FP and CFS. The 90-day mortality were collected using the Danish Death Register.

**Results:** Fifty-four percent (54 %) of the participants were female and mean age was 78.2 years (range: 65-100). Two hundred twenty-one (n=221) and n=555 participants were categorized as frail by FP and CFS, respectively and n=128 died within 90 days. The analyses revealed significant associations between frailty and 90-day mortality; RR=2.67 (95% CI: 1.93-3.69),  $p < 0.001$  and RR=4.12 (95% CI: 2.65-6.42),  $p < 0.001$  with FP and CFS, respectively.

**Conclusion:** There is a significant association between frailty and 90-day mortality in the Danish cohort. However, CFS is a better predictor of 90-day mortality compared to FP.

## Evaluation of dispatch outcomes and staffing of the Copenhagen mobile health and social care unit – Sociolancen

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DEMC8 abstracts

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**Background:** The mobile health and social care unit – Sociolancen (MHSCU) is a specialized unit within the Emergency Medical Services (EMS) of the Capital Region of Denmark. The unit provides acute social care for homeless and social deprived groups and is staffed with a social

worker and a paramedic and available through the EMS dispatch during daytime. The MHSCU is dispatched to citizens where the need for acute social care is suspected, falling outside the normal scope of practice for emergency ambulances. The aim of this study was to evaluate the dispatch outcomes of the MHSCU and the constellation of paramedical and social effort.

**Methods:** Data on the total number of MHSCU dispatches and outcomes in 2016 and 2017 was retrieved from the dispatch system operated by EMS Copenhagen. Outcome data was grouped for descriptive statistics.

**Results:** During the data collection period the MHSCU was dispatched 2976 times. The outcome resulted in 384 (12.9%) citizens being brought to a somatic emergency department (ED) and 255 (8.6%) citizens being brought to a psychiatric ED. A total of 355 (11.9%) citizens were left to selfcare and 196 (6.6%) citizens were brought to a shelter. Number of citizens handed over from emergency

ambulances was 41 (1.4%), number of citizens handed over to emergency ambulances was 4 (0.1%), number of citizens handed over to police was 13 (0.4%). In 1386 (46.6%) cases MHSCU were doing outreach work, citizen had left scene or MHSCU was cancelled. Number of dispatches labeled 'unknown' was 342 (11.5%).

**Conclusions:** The outcome of MHSCU dispatches indicate the need for both paramedical and social staffing when attending the homeless and social deprived citizens, as there is an approximately even distribution between health related and social related referral. Half of dispatches covers outreach work not within the normal scope of practice for emergency ambulances, enabling MHSCU to provide community service and security. Further, based on the low referral to emergency ambulances and police, the dispatch of MHSCU seems well-prioritized.

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## Is video communication technology building bridges between the primary health care and the emergency department in the Region of Southern Denmark?

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**Background:** In 2017, 2523 patients above the age of 64 were admitted from the community of Aabenraa to the Emergency Department (ED). Around 54% of them discharged from the ED within 48 hours. The aim of the CoLab project is to explore the information barriers in the transition of elder patients between primary health care (PHC) and the ED and back. Furthermore, to investigate whether a standardized communication tool combined with video communication technology improves the cross-sectoral communication and collaboration between nurses in the ED and PHC.

**Methods:** This was an exploratory and qualitative study. Data was generated from semi-structured group interviews with seven PHC nurses and two ED nurses. The standardized communication tool was developed from both a similar tool constructed by the Danish society for patient safety: ISBAR MED SALSA and the results from the interviews. Video communication via iPad was used between the acute care nurses in PHC and ED and a stationary video communication tool was installed between the ED and the two call centers in PHC.

**Results:** The interim analysis of the study so far suggests that it is not possible to establish a scheduled time for communication between ED and the PHC because of the established fast track patient pathways. Using a communication tool as guide for information sharing led to a higher quality exchange of information between PHC and ED. Both the PHC and ED nurses saw improvement in exchanging information by combining the standardized communication tool with video conferencing. This has raised the understanding of each other's work areas and the need for sharing information about the transition of the elder patients between the PHC and ED.

**Conclusion:** The project is still in progress. However, the midterm analysis has shown evidence that a standardized communication tool combined with video communication would improve the quality of cross-sectoral communication and collaboration between nurses in the ED and PHC. We believe that communication barriers should be reduced or eliminated in order to improve cross-sectoral collaboration and the continuity of care for the elder patient during the transition between PHC and ED.

## Trigger team activation for acute patients in a level 1 emergency hospital

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their prognosis can help qualify decisions in emergency medicine planning.

**Objectives:** To describe frequency, patient characteristics and 7-day mortality for all adult patients ( $\geq 18$  years) managed by the orthopedic, medical, neurological thrombolysis or primary percutaneous coronary intervention for ST elevation myocardial infarction (STEMI) trigger teams at Odense University Hospital (OUH).

**Methods:** All patients met by a specialized trigger team at arrival to OUH between 1 November, 2012 and 30 September, 2015 were included. Data on demographics, etiology and 7-day mortality will be presented descriptively. The number of trigger team activations per 100,000 person years in the background population, with varying catchment areas, will be presented.

**Results:** During the 35 observation months, there were 8,072 trigger team activations for adult patients at arrival to OUH (mean 7.6) per day. A trigger team was activated daily

**Background:** Emergency patients with suspected time dependent diseases are met by specialized trigger teams upon arrival at the hospital. These teams have an important function in stabilizing and treating patients. Knowledge of how often the different trigger teams are activated in combination with description of the patients and

1.3 times for trauma, 2.7 times for medicine, 1.5 times for thrombolysis, and 2.1 times for STEMI, or 161, 340, 72 and 64 activations per 100,000 person years, respectively. Mean age was 47 for trauma, and approximately 67 for the other teams. Some 72% of trauma and STEMI patients were male with 55% for medical and thrombolysis patients. Mean length of stay was 3-4 days for all groups. The 7-day mortality was 10% (95% CI 9-12) for trauma, 16% (95% CI 14-17) for medicine, 3% (95% CI 3-4) for thrombolysis and 6% (95% CI 5-7) for STEMI.

**Conclusions:** The volume of trigger team activation varied in both frequency and per 100,000 person years with activation of the medical teams being most frequent. Likewise, patients treated by the medical trigger team had the highest mortality, followed by trauma while patients activating the STEMI team showed the lowest mortality.

## Registration of Prehospital Vital Parameters

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**Background:** The North Denmark Region implemented an electronic Prehospital Patient medical Record (PPR) in 2006. In 2015 a new version of the PPR was implemented. Implementation of new technologies can be challenging, including structurally and organizational obstacles, which causes difficulty in achieving data completeness. The aim was to examine completeness of registrations of vital parameters in PPR before and after the new

version and examine the distribution of the registrations.

**Method:** The cohort includes all patients to whom an ambulance was dispatched after an emergency 112-call in the North Denmark Region from 2007-2014 and 2016. We examined the registration and distribution of six vital parameters, and included the first measurement. A trend analysis was used to assess the change in registration from 2007-2014, 2016. To exclude outliers in registrations we defined cut-points for systolic blood pressure (BP) (250mmHG), heart rate (HR) (250 beats per minute), and Respiratory Rate (RR) (100 breaths per minute), based on clinical relevance and their natural distributions. The other vital parameters had well-defined cut-points. We examined the distributions with and without outliers.

**Results:** We identified 220,173 patients. Percentage of registrations without outliers from 2007 to 2014 vs. 2016: BP 73% to 86% vs. 81%, HR 76% to 88% vs. 81%, blood oxygenation (SpO<sub>2</sub>) 72% to 85% vs. 81%, RR 34% to 82% vs. 77%, Glasgow-Coma-Scale-score (GCS) 54% to 92% vs. 81%, Numeric Rating Scale for pain (NRS) 0% to 16% vs. 24%. Data from all years showed normal distributions for systolic BP and HR with mean (95% confidence interval): 141.8 (141.7; 142), 91.9 (91.8; 92.1), respectively. For RR, SpO<sub>2</sub> and NRS; median (interquartile range) was: 18 (16; 20), 98 (95; 99), 6 (3; 8). From 2007-2014, 82% of the GCS-scores were on 15; in 2016 85% were on 15. There was 51% of the patients who had five vital parameters measured from 2007-2014 and 47% in 2016.

**Conclusion:** Registration increased significantly from 2007 to 2014, with a significant decrease in 2016, except for the NRS-score. The decrease in 2016 is probably attributed the implementation process. Overall vital parameters were within normal ranges, despite outliers in registration.

## Early detection of delirium – using the CAM score

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Assessment Method (CAM) would result in a higher recognizing of delirium in patients  $\geq 65$  years old admitted at Odense Emergency Department (FAM).

**Methods:** All caregivers in the Emergency department (ED) at Odense University Hospital received 2 hours of education in delirium and how to use the CAM score. They were asked to systematically perform CAM score in all patients  $\geq 65$  years at arrival to the ED and at least every 8 hours. During 2 periods of 5 days - one before the caregivers was educated (pre-CAM) and one 4 weeks after CAM scoring was started (during-CAM). A research team interviewed all  $\geq 65$  year old patients and their caregivers at the first and second day of admission. In relation to the interviews all patients underwent a cognitive assessment using the CAM by a trained investigator. These results were blinded to the

**Background:** Delirium is common in elderly patients and has been identified as an independent marker for increased mortality and hospital-acquired complications, yet it is poorly recognized by health care providers. The aim of this study was to investigate whether systematic use of the validated screening tool Confusion

clinical personal. After discharge patient files were screened with the aim to identify any delirium registered by the clinical personal.

**Results:** Out of 276 screened patients 192 were included in the project. 100 patients and were included in the pre-CAM group and 92 patients in the during-CAM group. According to the registrations by the research team 24 of 100 (24% 95%CI 16%-34%) patients experience delirium in the pre-CAM group and 18 of 92 (20% 95%CI 12%-29%) in the during-CAM group. Increasing age and comorbidity was related to delirium. Prevalence of the diagnoses delirium registered in the patient file increased from 1 of 24 (4% 95%CI 0%-21%) to 9 of 18 (50% 95%CI 26%-74%).

**Conclusion:** One out of four elderly acute patients has deliria symptoms during the first 2 days at hospital. Systematic CAM scoring does not change the prevalence but increase the awareness significantly. The high prevalence underlines the clinical importance of the problem.

## Frailty and mortality: Braden Scale is associated with mortality among elderly, infected patients admitted to an emergency department

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settings and has also been associated with mortality in some studies. The aim of this study was to examine the association between BS and 28-day mortality among infected elderly patients admitted to an emergency department (ED).

**Methods:** A prospective study conducted between 1st October 2017 and 31st March 2018 among elderly ( $\geq 65$  years) patients admitted to the ED at Slagelse Hospital with an infection. Information on BS (low-risk:  $BS \geq 19$ ; intermedium risk:  $13 < BS < 18$ ; high-risk:  $BS \leq 12$ ), and other relevant data was obtained from the patient records. Information on 28-day mortality was obtained from the Danish Civil Registration System. We have used logistic regression analysis to adjust for potential confounders of the association between BS and mortality. Changes in model fit were analyzed by the log-likelihood test.

**Background:** Infections can lead to serious clinical condition among the frail and elderly population and is associated with high mortality. Currently, no consistent use of frailty risk assessment tools is implemented outside geriatric departments. The Braden Scale (BS) for predicting pressure sore risk is used routinely in hospital

**Results:** A total of 1468 patients (52.0% female) aged  $\geq 65$  years with median age of 78.9 years (interquartile range 72.8-86.0) were included. BS was registered among 1072 (73.0%) patients. A total of 89 patients (8.3%) were in the high-risk group ( $BS \leq 12$ ), 508 (47.4%) were in the intermedium-risk group and 475 patients (44.3%) in the low-risk group. The overall 28-day mortality was 10.0%. Unadjusted odds ratio (OR) for mortality, with low-risk group as reference, was 2.21 (95% confidence interval (CI) 1.42-3.45) for intermedium risk and 7.66 (95% CI 4.34-13.51) for the high-risk group. Odds ratio for the patients with missing BS was 0.60 (95% CI 0.32-1.12). Adjusted OR was 2.02 (95% CI 1.29-3.17) and 7.46 (95% CI 4.16-13.35) for the intermedium and high-risk groups, respectively.

**Conclusion:** The Braden Scale can be used as a prognostic marker among elderly patients admitted to an ED with infection.

## Characteristic and help-seeking behavior of patients with infections who called the medical helpline 1813: a mixed methods study

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DEMC8 abstracts

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patients in contact with the Medical Helpline, we identified adult patients seen in the EDs with a diagnosis of infection (ICD-10 classification). Quantitative and qualitative (recorded voicelogs) data were extracted and a mixed methods study (convergent design) was performed. Descriptive statistics and logistic regression was used for the quantitative data strand. Thematic analysis was used for the qualitative data strand. Both data strands were integrated to describe the characteristics of the HSB of patients with infections.

**Results:** In total 3,614 adult patients were triaged to an ED, and 753 (20.8%) were diagnosed with infection of which 83 (11%) were hospitalized. ED patients with infection were

**Background:** Early identification of patients with serious infections is a clinical challenge for both medical helplines and emergency departments (ED). Serious infections might be difficult to identify as some patients present unspecific symptoms and a normal body temperature. It is therefore important to describe characteristics and help-seeking behaviour (HSB) with the aim to identify infections earlier.

**Methods:** The study population was part of a data collection carried out between 24.01-09.02 2017, at the Emergency Medical Services Copenhagen (Medical Helpline 1813). Among 11,340

younger (Median: 42 vs 47 years,  $p < 0.001$ ), more often without comorbidity (68.5% vs 74.5%,  $p = 0.006$ ) and more often females (64.1% vs 53.2%,  $p < 0.001$ ) compared to ED patients without infection. Hospitalized patients with infection were older (71 vs 40 years,  $p < 0.001$ ), and had more comorbidity (60.2% vs 39.8%,  $p < 0.001$ ) than those with infection who were not hospitalized. Fever was presented by 18 out of 32 hospitalized patients (56.3%) in the voicelogs. Some described that fever appeared with breathing difficulties, cough, and general weakness. Several patients had tried to self-manage their infection, but most calls (71.2%) were made by a close relative who was concerned. This illustrates that patients did not seek health professional help before their relatives were sufficiently concerned.

**Conclusion:** Hospitalized patients with infections were older and had more comorbidity compared to the non-hospitalized patients with infections. Among hospitalized patients with infections, fever was frequently presented in 1813-calls. Characteristic like self-management and concerned relatives are important to understand the HSB of hospitalized patients with infections.

## Hygiene perception and motivational factors of influence on high-quality hand hygiene performance among emergency medical service providers: Results from an international survey

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DEMC8 abstracts

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measures' feasibility to improve compliance and 3) motivational factors related to high-quality hand hygiene among the cohort.

**Methods:** A cross-sectional, self-administered questionnaire consisting of 24 items (developed from WHO's Perception Survey for Health-Care Workers) provided information on demographics, improvement feasibility of practical measures, and various subjective, normative and control beliefs among EMS providers from Finland, Sweden, Denmark and Australia.

**Results:** Overall, 933 questionnaires were returned (response rate 15%). Most respondents were advanced-care providers, male and had > 5 years EMS experience. In total, 61% received hand hygiene training < 3 years ago, and 93% perceived hand hygiene a routine. Most perceived access to hand hygiene supplies, and training and education as

**Background:** Hand hygiene a feasible practical measures to improve overall hand hygiene compliance. The majority acknowledged the scope and severity of health-care associated infections and the preventive effect of hand hygiene. Overall, 55% believed that hand hygiene was an organizational priority, 26% that it was important to their managers, 36% to colleges, and 58% to patients. Also, 44% perceived their colleges' hand hygiene compliance high ( $\geq 80\%$  compliance rate), 71% perceived hand hygiene relatively easy to perform. Organizational priority, peer pressure, and self-efficacy were separately associated with self-reported high-quality hand hygiene.

**Conclusions:** Hand hygiene supplies, simple and clear instructions, and training and education are highly warranted. Moreover, organizational priority, role models, and self-efficacy are motivational components with the potential to empower hand hygiene compliance within this cohort. Future interventional studies are needed to investigate the effect of a multimodal improvement strategy including both practical and behavioral aspects.

## Prehospital infection control and prevention in Denmark: A nationwide cross-sectional study on guideline adherence and microbial contamination of surfaces

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**Background:** Prehospital acute care and treatment have become more complex, and while invasive procedures are standard procedures, focus on infection control and prevention is scarce. We aimed to evaluate guideline adherence, microbial contamination, and associated risk factors.

**Methods:** In a nationwide cross-sectional study, we evaluated guideline adherence to thorough cleaning (TC) once a day, and moderate cleaning (MC) in-between patient courses. Microbial contamination on hand-touch sites (HTS) and provider-related sites (PRS) was assessed by total aerobic colony forming units (CFU) and presence of selected pathogens, using swab and agar imprints. Also, microbial contamination was assessed in relation to potential risk factors.

**Results:** 80 ambulances and coherent EMS providers were enrolled. Adherence to guidelines regarding TC was 35%, but regarding MC it was 100%. In total, 129 (27%) of 480 HTS presented a total CFU > 2.5/cm<sup>2</sup> and/or pathogenic

growth, indicating hygiene failures. The prevalence of selected pathogens on HTS was: *S. aureus* 7%; *Enterococcus* 3% and *Enterobacteriaceae* 1%. Total CFU on the PRS ranged from 0-250/cm<sup>2</sup>, and the prevalence of pathogens was 18% (*S. aureus* 15%, *Enterococcus* 3% and *Enterobacteriaceae* 0.3%). Methicillin-resistant *S. aureus* was found in one sample, and Vancomycin-resistant *Enterococcus* in two. No *Enterobacteriaceae* with extended-spectrum beta-lactamases were recorded.

**Conclusion:** Guideline adherence was suboptimal, and many HTS did not comply fully with proposed standards for cleanliness. Pathogens were demonstrated on both HTS and PRS, indicating that the EMS may be a source of infection in hospitalized patients. Moreover, cleaning effort and time appears associated with microbial contamination, but a comprehensive investigation of risk factors is needed.



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