

Out-of-Hospital Cardiac Arrest (OHCA) attempted resuscitations Annual Report 2021

ENGLISH VERSION



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1 DISCLAIMER AND COPYRIGHT, AUTHORS AND ACKNOWLEDGEMENTS

This publication was produced by the Corps Grand-Ducal d'Incendie et de Secours (CGDIS), Medical and Health Directorate.

This publication is our first annual report and is produced to provide an overview of attempted resuscitations in out-of-hospital cardiac arrest (OHCA) statistics and outcomes in the country of Luxembourg. Record data from 19 fire and rescue centers (CIS) were used. Not all OHCA were included as OHCA with no resuscitation attempts (including “do not resuscitate” orders or signs of obvious death) were excluded. As a limitation, we must report, that due to the retrospective and voluntary participation in this OHCA listing, the data analysed represent a sample and may not be complete. This report is a summary of the main data analysis.

In the following, the overall available data from 01.01.2021 to 31.12.2021 were included.

Statistical test chi-square was used.

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in the completion of this report.

OVERVIEW 2021

263

Resuscitation attempts



AGE 65,2
61,6%



AGE 72,7
38,4%

CPR initiated by bystanders

43,7%

% of CPR by bystander if witnessed OHCA

57,6%

% of shockable rhythms % of initiated t-CPR after CA detection by dispatcher

29,7%

56,14%

OVERALL % ROSC

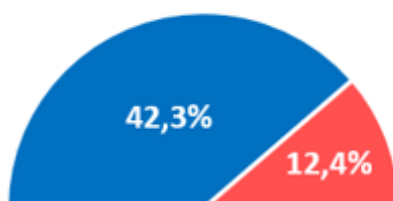
21,29%

% ROSC Utstein

42,22%

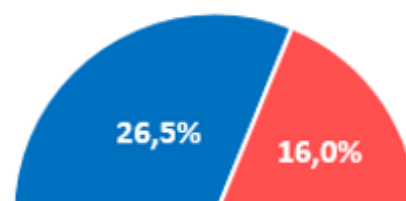
% ROSC IF :

SHOCKABLE RHYTHM ?



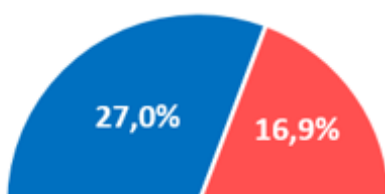
■ SHOCKABLE RYTHM ■ NO SHOCK

WITNESSED OR NOT?



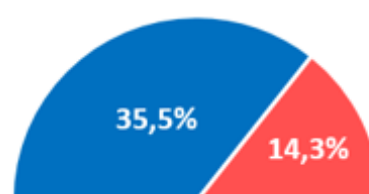
■ WITNESSED ■ UNWITNESSED

OVERALL - BYSTANDER CPR ?



■ BYSTANDER CPR ■ NO BYSTANDER CPR

WITNESSED OHCA - BYSTANDER CPR ?



■ BYSTANDER CPR ■ NO BYSTANDER CPR

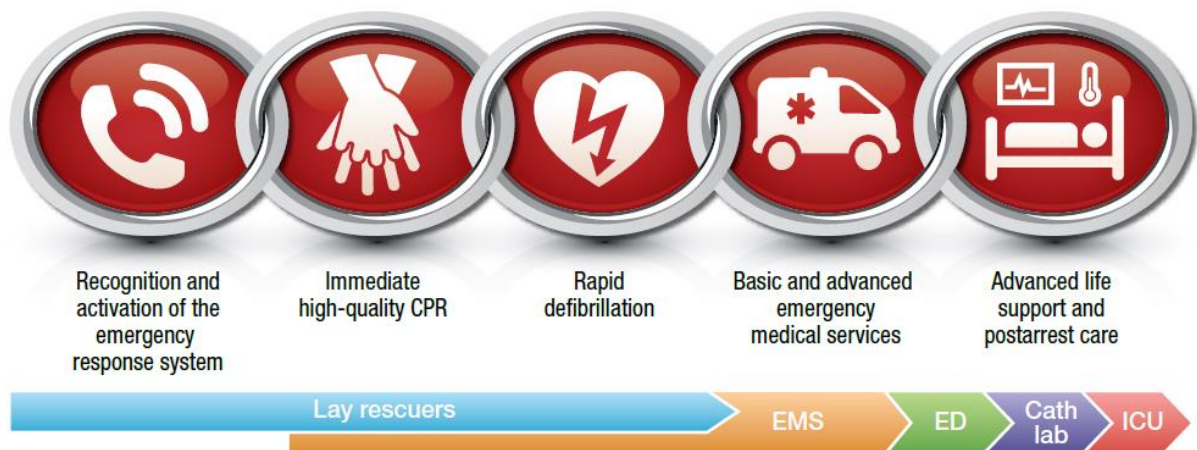
2 INTRODUCTION

Every year in Luxembourg, people die after an out-of-hospital cardiac arrest suddenly bursts into their lives.

The overall 30-day survival described worldwide is often less than 10%. At the service of the population, the CGDIS is very involved in improving this survival, by providing rapid response, help and quality care.

But we can't do it alone.

The survival rate after an OHCA depends on multiple factors included in the chain of rescue.



American Heart Association ¹

We need the whole luxembourgish population (lay bystanders) to resuscitate by learning how to perform cardio-pulmonary resuscitation (CPR) and to use an external automated defibrillator (AED). Survival is largely due to the quick first actions of bystanders. For every minute without CPR or defibrillation, the chance of survival falls by 10%!

Alongside the community role, CGDIS has a strong role in this chain of rescue and survival at multiple levels :

- By the action of dispatchers and dispatch nurses working in the national dispatch center 112.
- By the care provided by first responders, ambulance-firefighters and emergency physicians and nurses (SAMU)

Through this report, we want to communicate the data we have collected in order to try to improve the chain of survival by raising awareness of possible points of improvement.

We hope this report serves also for our staff as a reminder of the importance of their work. We want also express them the gratitude we have for their involvement in delivering each day an excellent patient care.

Dr Olivier PIERRARD
Head of Medical and
Health Directorate

Dr Valentin HAJEK
Head of Medical
Rescue Department

“Cardiac arrest is the abrupt loss of heart function in a person who may or may not have been diagnosed with heart disease. It can come on suddenly or in the wake of other symptoms. Cardiac arrest is often fatal if appropriate steps aren’t taken immediately”

American Heart Association

3 THE IMPORTANCE OF FIRST AID

Providing first aid is a very important topic that has become an integral part of our everyday lives. Often many people are still afraid of doing something wrong, but "anyone can save lives". You don't need a lot of previous medical knowledge to give first aid. Making an emergency call, securing the scene of an accident or simply providing assistance to the injured are already among the most important first aid measures.

With a little practice, which everyone get through the first aid course, people can even learn to perform more than just the above-mentioned measures. It teaches how to apply the recovery position to a patient or what needs to be observed during resuscitation. The step into the first aid course can already help to take away people's fear because they are taught how to behave in such exceptional situations.

People are affected by accidents and all kinds of life-threatening illnesses every day. These can occur within the family, in friendship groups, in a sporting environment, at work or when taking part in a leisure activity. If a situation of this kind arises, it is important to seek help as quickly as possible and to implement first aid measures. The first people from the emergency services to be contacted in rural areas are generally first responders, followed by an ambulance with or without an emergency doctor. The emergency services will treat the affected person under the best possible conditions and transport them to hospital. Unfortunately, valuable minutes are lost between the occurrence of the emergency and the arrival of professional assistance. In some cases, these few minutes can be the difference between life and death and can significantly influence the prospects of the affected person. This first aid course should help everyone to recognize emergency situations more quickly and make the best use of the time before the emergency services arrive.

The working load for emergency services and hospital will be often more important if no first aid is provided in acute cases and if this part of the rescue chain is lacking. The first aider therefore has a major influence on the person's chance of survival and is a most important link in the rescue chain in life-threatening emergency situations, such as cardiopulmonary resuscitation.

CGDIS offers a large number of public courses each year. The initiative usually lies with the communities to request a public course at their premises, and for this reason, this number fluctuates every year.

For the last two years, we have been proactively writing to the different CIS from the municipalities to organize public courses in their premises. We also write to our trainers who are always motivated to offer courses in the 100 different rescue centers.

Besides the public courses, CGDIS also offers corporate courses. These take place either at the companies themselves or at our Centre National d'Incendie et de Secours (CNIS). The demand for first aid courses is currently very high, so that the first semester of 2022 was already fully booked at the beginning of the year, except for a few holiday dates.

In 2021, CGDIS offered 296 first aid courses with 4489 participants.

Not only private individuals, but also companies and businesses are increasingly recognizing the importance of attending a first aid course.

Aline STRACKS
Head of Department – Public formation
Institut National de Formation des Secours

4 DEMOGRAPHICS

4.1 Number of patients

During the year 2021, **263** resuscitation attempts by the CGDIS's EMS teams for patients with sudden OHCA were recorded.

4.2 Incidence of OHCA

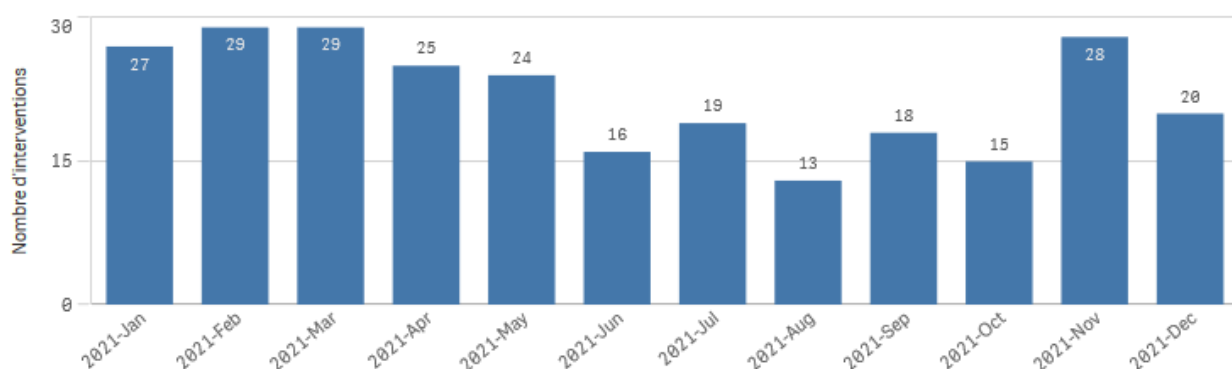
Applied to the resident population at 01.01.2021 following STATEC data, annual incidence rate of OHCA with resuscitation attempt is **41.4/100.000 inhabitants**.

Annual Incidence rate / 100.000 inhabitants

41,43

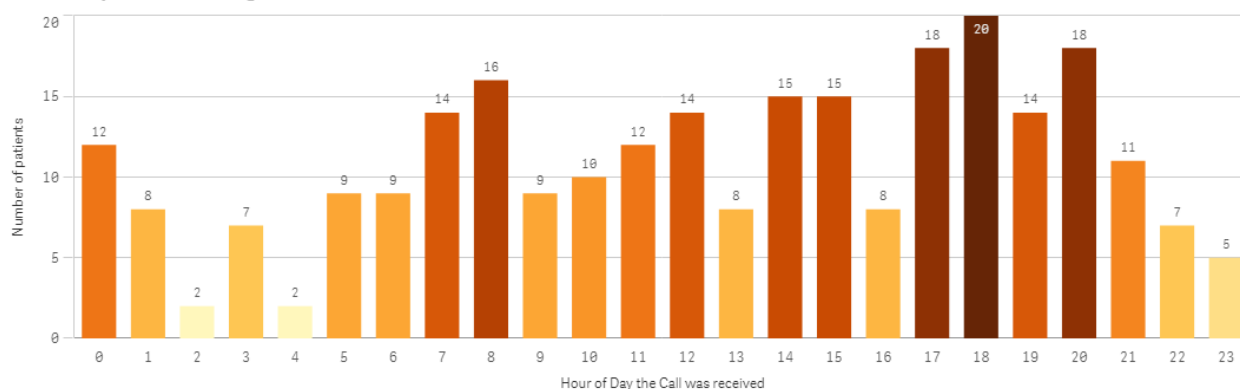
4.3 Cardiac arrests by month

Average OHCA resuscitation attempts is 22 per month [min 13- max 29].



4.4 Cardiac arrests by hour of received call

Number of patients following Hour of Call



4.5 Gender / Age breakdown

The average age of victims was **68** years. Average age was 65,2 years of age for men, with a higher average age in women with 72,7 years.

Sex Ratio H/F was 1,62.

61,6% of victims were male and 38,4% were female.

Average Age of victims

68,0

Sex ratio H/F

1,62



AGE 65,2
61,6%

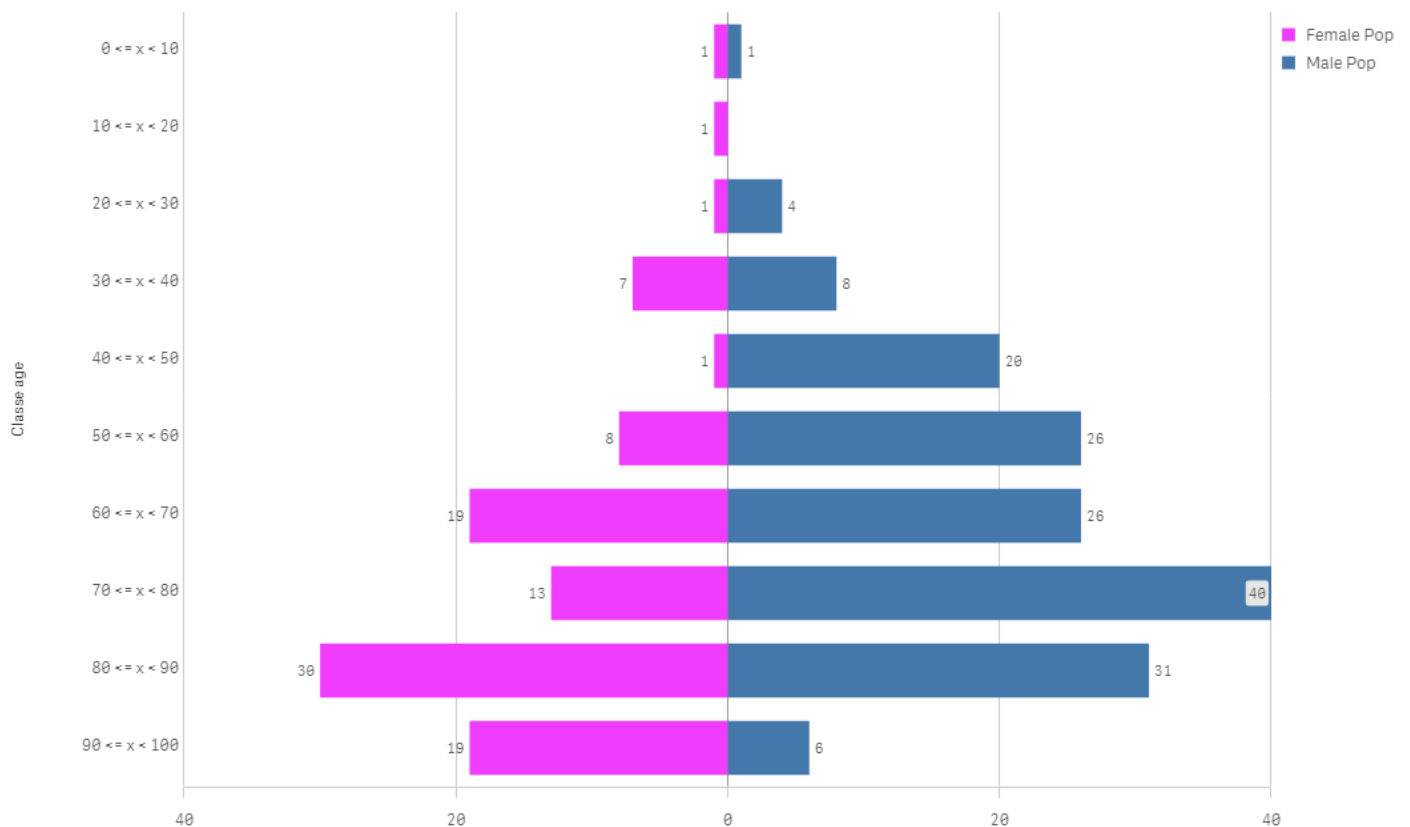


AGE 72,7
38,4%

98,9% of OHCA with resuscitation attempts concerned adult population above 20 years of age.

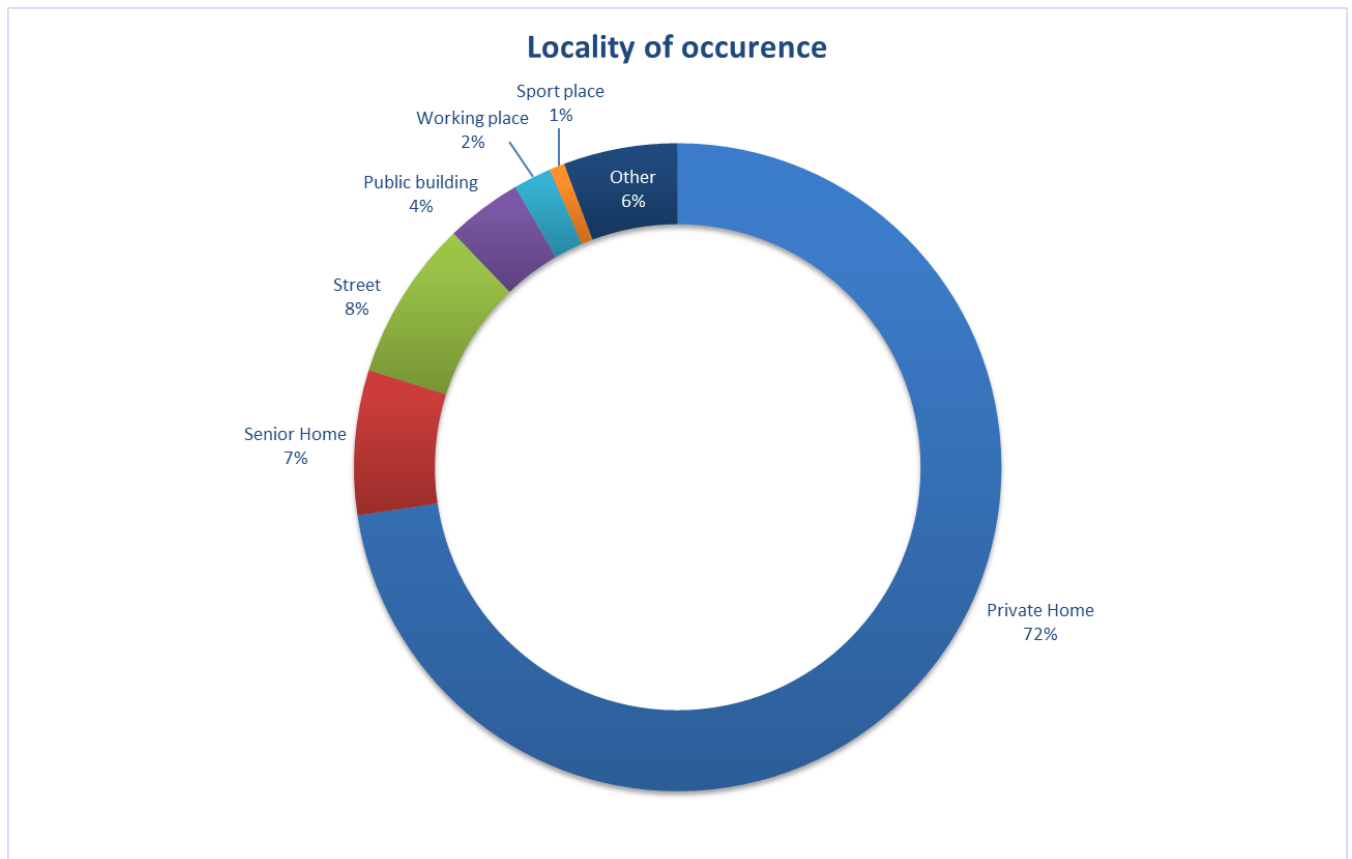
The proportion of patients aged over 80 years was 32,7%.

Age pyramid of victims



4.6 Sites of occurrence of cardiac arrest

The most common place for an OHCA to occur is in a person's home. 80% of OHCA with resuscitation attempts occurred in a private home or a senior residence. The second common place is in a public area, like the workplace, the street, a sport area, a public building or similar.



5 THE CHAIN OF SURVIVAL IN LUXEMBOURG

Time delays between cardiac arrest and treatment are crucial. Survival depends not only on the rapid response from EMS but also on citizens' acts. Witnessed events, bystander CPR started before EMS arrival, EMS response time, and time to defibrillation are linked to higher survival.

5.1 Recognition of cardiac arrest

In 2021, 74% of likely detectable OHCA were correctly identified par dispatchers.

% of detected OHCA if likely detectable

74,03%

5.2 Early chest compressions

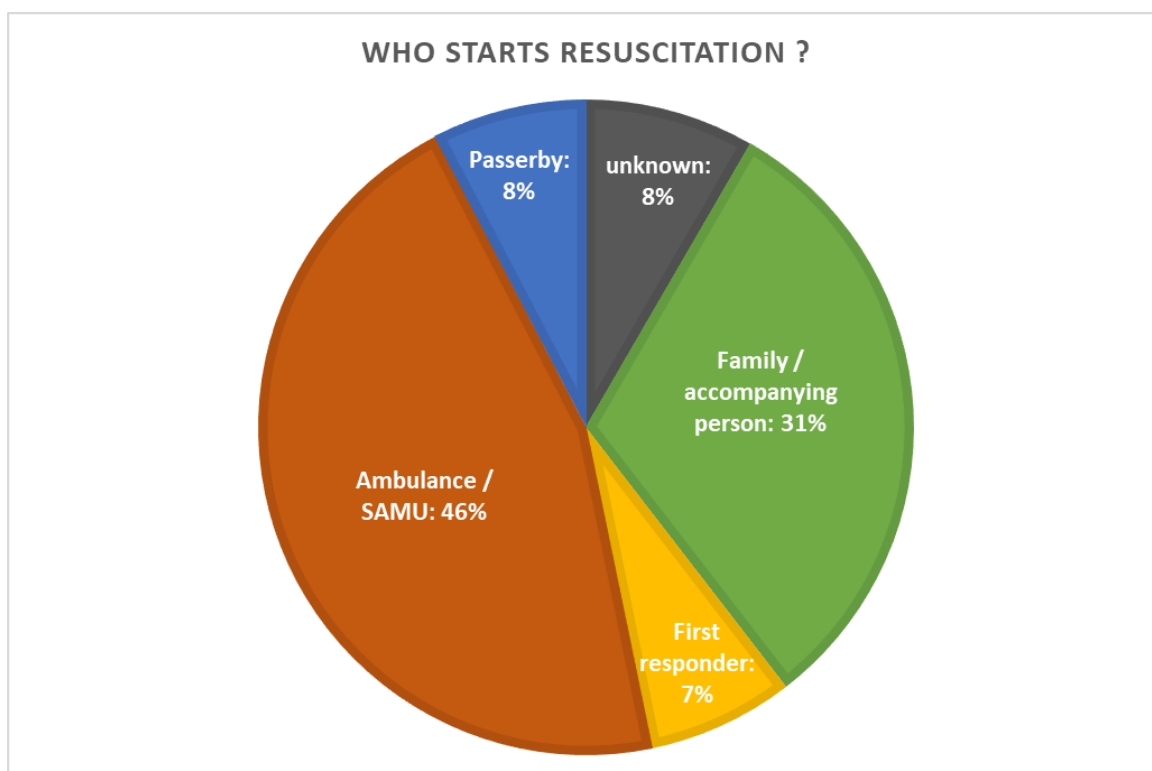
It is well known that starting chest compressions as soon as possible on a person without visible signs of life will ensure vital organs to receive oxygen and increase the likelihood of survival following an OHCA.

According to 2021 data records, CPR was initiated by laypersons in 43,7% of patients with OHCA.

CPR initiated by bystanders

43,7%

In 7,2% of the cases, first responders carried out CPR before the ambulance and/or SAMU arrived.



Nearly half of OHCA occurred in front of witnesses. Bystanders began CPR in 57,6% of these witnessed OHCA.

Witnessed OHCA

50,2%

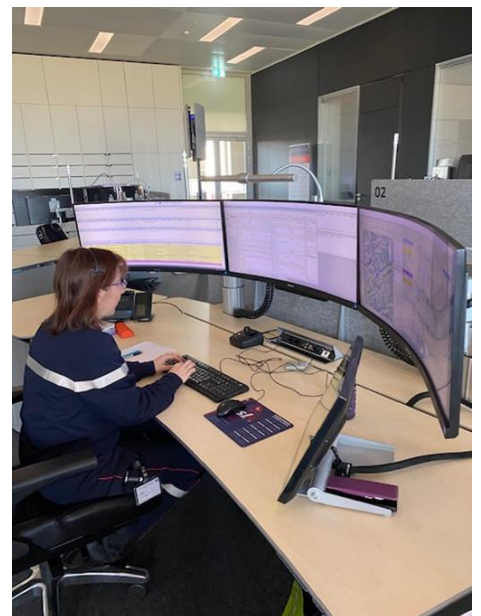
% of CPR by bystander if witnessed OHCA

57,6%



For improving the initiation of CPR by bystanders, emergency dispatchers and dispatching nurses working in the 1-1-2 call center are instructed to give telephone guidance for CPR when possible (T-CPR).

When a cardiac arrest was identified by a dispatcher, telephone-assisted CPR was done, or tried to be done in 56% of cases. Unfortunately, in 31% of these cases, bystanders were not able to perform CPR due to physical, emotional or comprehension factors.



% of initiated t-CPR after CA detection by dispatcher

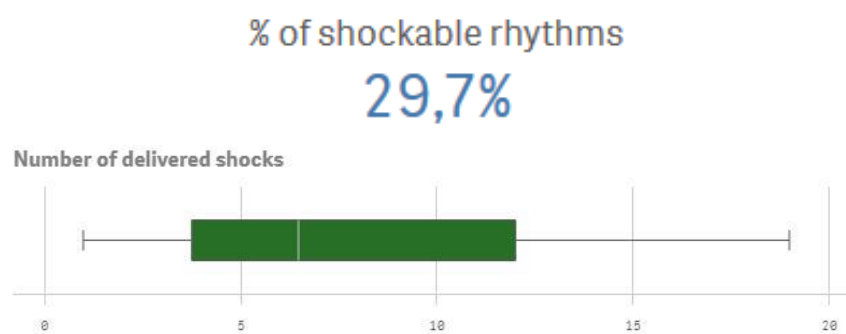
56,14%

5.3 Rapid defibrillation



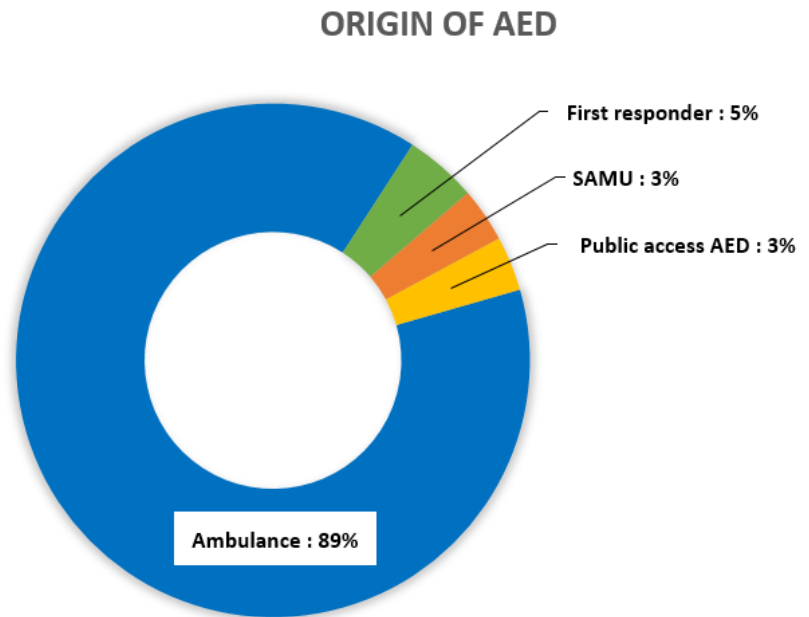
In 95% of cases, the average time between the alarm and the use of defibrillator was **10 minutes and 46 seconds**.

29,7% of overall OHCA recorded were in shockable rhythm. Average number of delivered shocks was 4. The range of delivered shocks is between 1 and 19, with first quartile at 3,75 and third quartile at 12.



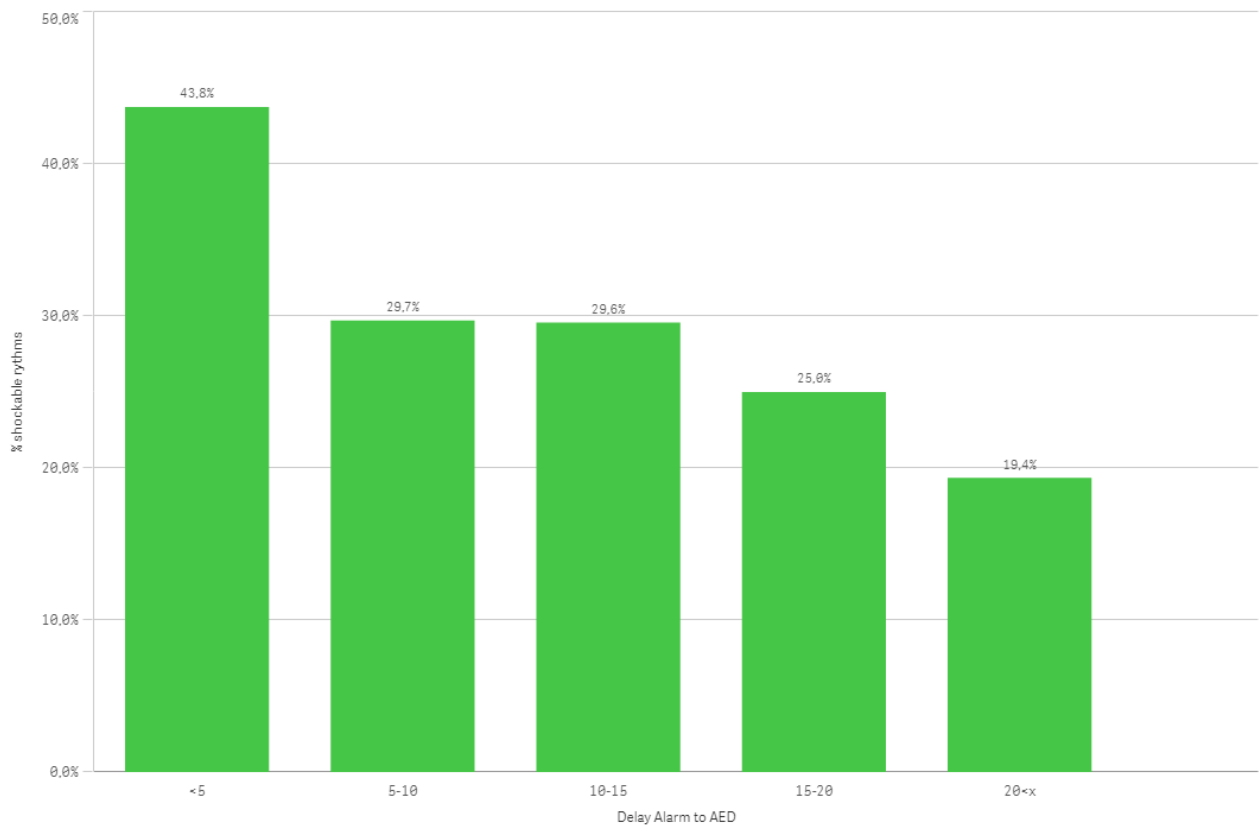
In a great majority of cases, the AED used was originated from EMS teams (first responder, ambulance or SAMU).

Use of public access AED was rare, only for 9 patients (3,4% of cases).



The availability and the speed of use of AED's are known to increase the likelihood of recording a shockable rhythm, the only one that can be defibrillated by an AED. Our data confirm these facts with 44% of shockable rhythms observed when an AED is used within 5 minutes and a progressive decay thereafter.

% shockable rhythms following delay Alarm-AED



5.4 Basic and advanced emergency medical services

The average time between receiving the alarm and arriving at the scene with the ambulance was **8 minutes and 9 seconds** with a median time of 8 minutes.

In 95,4% of all OHCA, the ambulance arrived within the first 15 minutes after alarm.



5.5 Early access to advances post cardiac arrest care

Across Luxembourg, only one hospital is capable of providing percutaneous coronary intervention (PCI) or initiation of extracorporeal membrane oxygenation (ECMO).

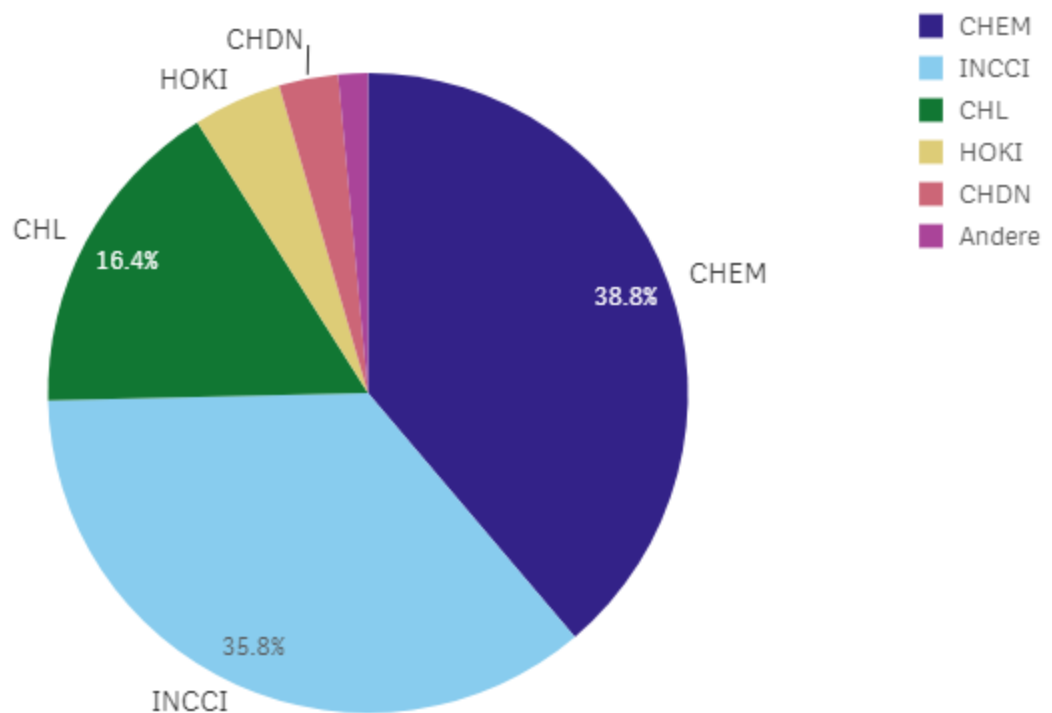
When ROSC is not achieved, a transport with continuous reanimation under LUCAS is possible for an ECMO treatment. Indications for ECMO are :

- Patient with no major comorbidity
- No flow (time without RCP) < 5 minutes
- Initial shockable rhythm of VT/VF
- EtCO₂ > 10mmHg
- +/- signs of life

In 2021, 9 patients (3,4%) had an initial shockable rhythm and were transported under continuous reanimation.



Destination if Transport with ROSC or Reanimation



6 PERCENTAGE OF ROSC & UTSTEIN ROSC

The return of spontaneous circulation (ROSC) can be used as an initial marker of successful resuscitation.

Among the 263 patients who received resuscitation attempts, **ROSC was achieved in 56 patients (21,3%)**.

OVERALL ROSC

21,29%

As usually described in international literature data, ROSC was more often achieved, in our observation, in case of :

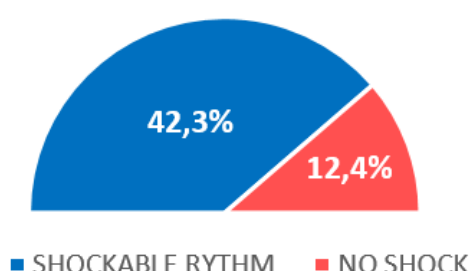
- Bystander initiated CPR (% ROSC = 27%)

-Witnessed OHCA (% ROSC = 26,5%)

-Witnessed OHCA with bystander CPR (% ROSC = 35,5%)

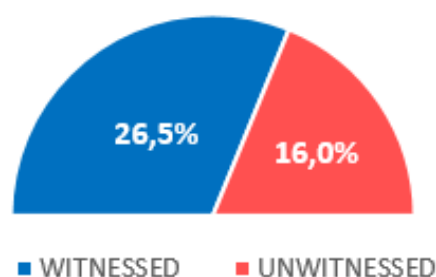
-Initial shockable rhythm (% ROSC = 42,3%)

SHOCKABLE RHYTHM ?



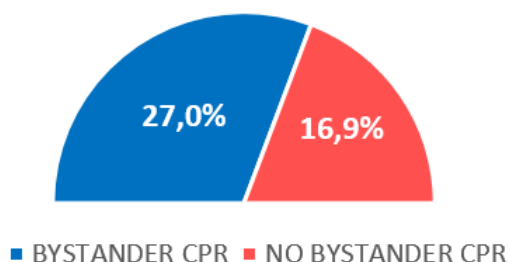
$p < 0,001$

WITNESSED OR NOT?



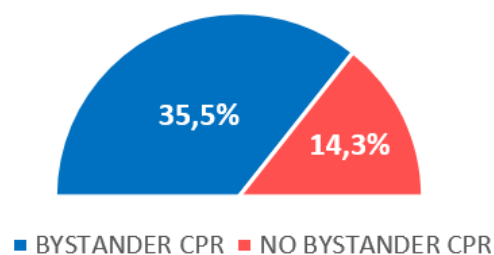
$p=0,038$

OVERALL - BYSTANDER CPR ?



$P=0,048$

WITNESSED OHCA - BYSTANDER CPR ?



$P=0,006$

For international comparison, a subgroup is described : **the Utstein cohort**, if the following criteria are met :

-All-cause

-Resuscitation attempted

-Shockable presenting rhythm

-Bystander witnessed

45 patients fulfilled criteria for Utstein group. ROSC was obtained in 42,22% of these patients.

% ROSC Utstein
42,22%

Although ROSC may be seen as a preliminary success indicator, the goal of resuscitations is to return the patient to his quality of life he had prior to the OHCA. This can only be achieved by early, high quality CPR including AED use.

7 DISCUSSION / CONCLUSION

The observed annual incidence of OHCA with attempted resuscitation is in accordance with European Resuscitations Council facts (between 19 to 97 per 100,000 inhabitants)². In Germany, the annual incidence of CPR observed in 2019 was 62,6 CPRs per 100,000 inhabitants³. This Luxembourgish incidence is probably underestimated because the actual dataset is retrospective and non-compulsory. We hope in the next few years to improve the completeness of data with prospectively recorded results of OHCA.

Public campaigns aim to draw the attention of the general public to the recognition of sudden cardiac death and possible CPR by bystanders. The rate of bystander CPR varies largely across European countries, between 13%-83%². The 43,7% in our observation is below the European average (58%)² and discloses a need for progression, in particular for witnessed OHCA where the rate was still only 57,6%.

Our median EMS response times was quite good, 8 minutes, while only 32% of urban areas of European countries aim to have a median response time under 10 minutes².

Luxembourg, as 80% of European countries², provides dispatch assisted CPR. CGDIS is acting for improving rapid OHCA detection when call is received as well as the rate of T-CPR. A study in Florida found that the lack of recognition of OHCA by emergency medical dispatch occurred in most calls due to difficulty communicating the subject's respiratory status. The conclusion was that further emphasis should be placed on identifying non-viable respirations in unconscious patients in emergency medical dispatch training and algorithms to increase recognition of OHCA and initiation of T-CPR⁴.

Use of public AED is low, 3,4% in our observation. New initiatives across Europe were proposed for increasing the likelihood of having an AED deployed to the scene (e.g the use of drones, the use of App-based systems⁵ to locate and send bystanders to attend the OHCA and start CPR immediately as well as to send a second person to get an AED...)².

ROSC rates are very different between countries. The next table presents some examples of overall ROSC and Utstein ROSC found in the literature^{3,6-10}.

Year	Country	Overall ROSC	Utstein ROSC
2021	Luxembourg	21,3%	42,2%
2018-19	UK (London)	35,7%	62,6%
2017-2019	Belgium (Brussels-Capital Region)	40,22%	
2019	Germany	45,9%	
2013-14	Spain	30,4%	
2019-20	Canada (British Columbia)	24,8%	45,1%
2020	Ireland	23%	51%

Unfortunately, the rate of ROSC is only one indicator. CGDIS has no view over further evolution of patients transported with ROSC. CGDIS's teams have currently no return over cerebral hypoxia or cerebral anoxia. Luxembourg, at the moment, does not have any national registry of OHCA integrating not only prehospital data but also survival rates at hospital discharge, at 30 days follow-up and long term outcomes. A legal basis for the establishment of a national registry is an essential prerequisite.

Much remains to be done to reduce morbidity and mortality after an OHCA and CGDIS stands ready to participate alongside other major actors of the chain of survival in future improvement projects.

8 DEFINITIONS

Bystander CPR : includes all CPR efforts (witnessed or unwitnessed OHCA) initiated before EMS arrival. Bystanders can be a lay person without previous any CPR training, someone who has undergone prior CPR training or be an off-duty (para)medical professional.

Bystander witnessed CPR : includes all bystander initiated CPR when cardiac arrest occurs in front of witness (seen or heard).

ROSC : return of a spontaneous circulation with palpable pulse or measurable blood pressure.

T-CPR : Telephone cardiopulmonary resuscitation is a cardiopulmonary resuscitation with instruction given by emergency dispatchers or dispatching nurses.

Unwitnessed : includes all cardiac arrest occurring without direct witness.

Utstein : Refers to the internationally recognized criteria for standard characterization of OHCA.

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