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Importance of out-of-hospital cardiac arrest recognition delay during a phone call to a dispatch center

Noémie Viala, Alexandre Lamant

► **To cite this version:**

Noémie Viala, Alexandre Lamant. Importance of out-of-hospital cardiac arrest recognition delay during a phone call to a dispatch center. Human health and pathology. 2020. dumas-04380624

HAL Id: dumas-04380624

<https://dumas.ccsd.cnrs.fr/dumas-04380624>

Submitted on 8 Jan 2024

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**IMPORTANCE DU DELAI DE RECONNAISSANCE
TELEPHONIQUE
DE L'ARRET CARDIAQUE EXTRAHOSPITALIER
LORS D'UN APPEL A UN CENTRE DE REGULATION**

THÈSE

PRÉSENTÉE POUR L'OBTENTION DU TITRE DE DOCTEUR EN MÉDECINE

DIPLÔME D'ÉTAT

Noémie VIALA, [Données à caractère personnel]

Alexandre LAMANT [Données à caractère personnel]

Thèse soutenue publiquement à la faculté de médecine de Grenoble

Le 02/09/2020 devant le jury composé de :

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Mme le docteur GAIDE-CHEVRONNAY Lucie

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REMERCIEMENTS

A Monsieur le Professeur José Labarère

Merci d'avoir accepté la présidence de ce jury de thèse. Nous vous sommes grandement reconnaissants pour votre aide concernant les statistiques. Veuillez trouver dans ce travail l'expression de notre reconnaissance et de notre profond respect.

A notre directeur de thèse, Monsieur le Professeur Guillaume Debaty

Merci pour ton accompagnement, ainsi que tes précieux conseils. Nous te remercions sincèrement.

A Monsieur le professeur Gerald Vanzetto

Vous nous faites l'honneur de juger cette thèse. Nous vous remercions de l'intérêt que vous portez à ce travail. Veuillez recevoir l'expression de notre respectueuse gratitude.

A Madame le docteur Lucie Gaide-Chevronnay

Nous vous remercions d'avoir accepté de siéger à ce jury de thèse et de juger ce travail. Nous vous prions de recevoir l'assurance de notre respectueuse considération.

Un grand merci au **Dr Damien Viglino** pour son aide précieuse, à **Hélène Duhem** pour ses conseils, et à **Caroline Sanchez** pour son accompagnement depuis le SAMU 38.

Remerciements de Noémie

Mes pensées vont en premier lieu au Pr Gérard Guiraudon, à qui je dédie humblement et symboliquement ce travail ; il a été mon mentor, lui, le pionnier de la première transplantation cardiaque de 1968, sans qui je ne serais pas médecin aujourd'hui.

Merci à toi Alex, d'avoir partagé avec moi ce travail de thèse, merci pour ta rigueur et ta capacité de travail.

Je remercie sincèrement mes parents et ma Sœurlette qui m'ont toujours soutenu dans mes choix, même sans savoir où j'allais. Merci à Anthony pour tout, notamment ton bon sens, tu es si précieux à mes côtés ! Merci aussi à mes oncles, tantes et cousin(e)s pour leurs encouragements et leur bonne humeur. J'ai bien sur une pensée émue pour mes grands-parents qui auraient été fiers de moi.

Merci à mes colocataires d'avoir littéralement vécu avec moi ces années d'internat : Mariette, Cloé, Thibaut, Jean Charles et Lisa à Grenoble, Cécile et Sarah à Chambéry, Laurent et Sid aux Gêts, et tout récemment Lucie et Gaëlle.

Je remercie les belles personnes rencontrées au cours de l'internat que clôture cette thèse : ma Camille, Lisa, Hélène, Maud, Sabrina, Lucie M ; et puis je ne nommerais pas tout le monde, mais je pense en particulier aux copains de DESC, à ceux de l'internat, à tout le petit monde du cabinet médical des Gêts. Sans oublier les médecins qui m'ont inspiré, dont René Pierre JP et Gaspard M chez SOS, Guillaume De Véricourt pour sa tutelle. Une mention spéciale à Céline, Flavie, Anne-Claire, Romain et Caro mes super chef(fe)s de l'UPU de Chambéry. Merci enfin à l'équipe des urgences de Voiron pour sa bienveillance, à Pierre Dudu pour la formation en médecine de montagne, à Pauline et Nathalie à l'UPU pour le partage de bureau/de vécu de pandémie...

Encore un grand merci à ceux qui m'ont accompagné avant et pendant ces années de médecine : la liste est aussi longue que les études... C'est mes amis à l'ISIFC : Lauriane, Arnaud, Manue, Marjo, Adrien, Joe et bien sûr Julien, vous aviez cru en moi quand je vous ai dit que je voulais « faire médecine ». Merci à Nadia Butterlin et au Pr Joseph-Philippe Etiévent d'avoir rendu cela possible en m'épaulant jusqu'au bout.

Pour finir en beauté, merci du fond du cœur aux Bisontin(e)s de l'externat, Lucie et Cécile le binôme qui m'a sauvé en P3, Sarah et Lucie qui m'ont sauvé en D4, Juliette qui continue à me sauver, et bien sûr Jean, Clément, Laura, Nico, Isaac, Quentin et Tiphaine. Une pensée de plus pour mes deux plus vieilles copines Tania et Emilie qui, mine de rien, sont toujours là quand il faut.

Et puisqu'on y est : merci à mes tous nouveaux collègues des urgences du CHU de Grenoble pour leur accueil, malgré toutes les difficultés que vit l'hôpital public, vous êtes admirables.

Remerciements d'Alexandre

A toi Noémie : pour m'avoir proposé ce travail, pour ta motivation, ta persévérance et ton enthousiasme sans faille. Ce fut un plaisir de partager la réalisation de cette thèse avec toi !

Aux copains de Toulouse :

Val, un grand merci pour ton aide et ta disponibilité pour la traduction de cette thèse. Mais également pour ces moments un peu rudes à la BU droit, comme pour ces nombreux bons moments à débattre autour d'une bière, passés comme à venir !

Ludo, merci pour cette première coloc riche en sensations et pour ce soutien mutuel lors de ces longues sessions de révisions/FIFA ! 3 belles années inoubliables.

Flo merci pour avoir rendu les sous colles si énergiques et d'avoir partagé ta passion excessive pour le lupus ! Mais surtout merci pour ce voyage post ECN avec **Adri** et **JB** qui restera un souvenir fabuleux.

Oussama, merci pour tous ces bons moments de franche camaraderie !

Merci aussi à tout le reste de la bande, pour avoir rendu cet externat aussi intense ! RDV à Montgenèvre 2021 !

Aux copains de l'internat du 1^{er} semestre qui ont transformés ces 6 premiers mois de découverte en une si belle période ! Cilou, Guigui, Sab, Neral, Véro, Mat', Loïc, Lucie, Bretzel, Tonio, Cec', Michel, Charlotte et tant d'autres !

A tous mes co-internes (Lisa, Hélène, Elliott, JC, Force virile, Junior, Anne, et j'en oublie tellement) **et toute la promo de DESC** pour tant de solidarité et de bons moments passés ensemble !

Une pensée particulière pour toi **Guigui** et toi **Sab** et cette incroyable coloc à Morillon, pour toi **Cilou** et ta présence tout le long de cet internat, et pour toi **Elliott** et tes raclées accumulées au tennis à Morzine !

Bien évidemment un grand merci à tous mes maîtres de stages, et à toutes les équipes hospitalières qui m'ont tant appris pendant ces années d'internat, tant sur le plan professionnel que sur le plan humain. Merci au **docteur Lucie Gaide-Chevronnay** de m'avoir tant appris durant mon stage en réanimation et d'avoir accepté de participer à ce jury de thèse.

Mais également un grand merci à toute l'équipe des urgences du GHM pour m'avoir accompagné ces derniers mois pour mes premiers pas « en tant que grand » !

Sans oublier les plus importants, ma famille, sans qui rien n'aurait été possible :

A mes parents : A toi Papa, et à toi Maman, un grand merci pour tout, je vous dois tant. Même si je ne vous ai pas toujours facilité la tâche vous avez toujours été présents et su trouver les mots justes. Vous m'avez tant appris, comme vous m'avez tant donné... Bravo pour cette belle famille que vous avez construite.

A Marie : Merci à toi sœurlette d'avoir toujours été une source d'inspiration et d'avoir été toujours présente peu importe la situation. D'avoir su me donner la motivation et de m'avoir épaulé durant ces longues années d'études. Mais aussi pour tous ces moments de complicité depuis tant d'années. Tu resteras un modèle pour moi. Hakuna Matata !

A Jean et à Louis ; mes frérots ! Merci pour tous ces moments de rigolade et de complicité qui j'espère ne cesseront jamais ! Merci Jeanou pour ton humour et ta motivation, ces multiples sessions sportives ! Merci Loulou d'avoir toujours été disponible et attentionné.

A Quentin, « nouveau » membre de la famille, merci d'avoir pris le temps de répondre à chacune de mes interrogations cardiologiques avec tant de patience.

A Juliette : Petit rayon de soleil dans cette dernière ligne droite et véritable concentré de vitalité au quotidien. Je suis fier d'être ton tonton !

A la famille de Léo pour leur gentillesse à toute épreuve !

Et bien évidemment et principalement à toi **Léonore**.

Déjà 11 ans d'aventures ensemble, et tellement à venir. Merci pour ton soutien inconditionnel et d'avoir fait preuve de tant de patience durant toutes ces années d'étude.

Mais surtout merci d'être mon moteur au quotidien et de partager ma vie depuis tant d'années...

Le plus beau reste à venir !

LISTE DES ABRÉVIATIONS

AED: Automatic External Defibrillator

AHA: American Heart Association

AI: Artificial Intelligence

CA: Cardiac Arrest

CPR: Cardiopulmonary Resuscitation

DA-CPR: Dispatcher-assisted Cardiopulmonary Resuscitation

EMS: Emergency Medical Services

ILCOR: International Liaison Committee on Resuscitation

OHCA: Out of Hospital Cardiac Arrest

MeSH: Medical subject heading

QUIPS: Quality in Prognostic Studies

PRISMA: Preferred Reporting Items for Systematic review and Meta-Analysis

DL: Distance learning

SAMU: Service d'Aide Médicale Urgente

VF: Ventricular Fibrillation

ROSC: Return of Spontaneous Circulation

ECCS: Emotional Content and Cooperation Score

NAEMD: National Academy of Emergency Medical Dispatch

RÉSUMÉ

L'objectif de ce travail était d'évaluer l'impact du délai de reconnaissance de l'arrêt cardiaque extrahospitalier par le centre de régulation lors d'un appel par un témoin. L'assistant de régulation médicale est à l'initiation de la chaîne de survie. Une reconnaissance rapide de l'arrêt cardiaque est un facteur majeur pour permettre l'initiation immédiate de la réanimation cardio-pulmonaire par le témoin avec assistance téléphonique avant l'arrivée des secours professionnels sur les lieux.

Nous avons dans une première partie réalisé une revue systématique de la littérature selon la méthode PRISMA avec méta-analyse de 13 études s'intéressant au délai de reconnaissance téléphonique de l'arrêt cardiaque extrahospitalier. Nous avons montré un impact du délai de reconnaissance sur la survie de l'arrêt cardiaque extrahospitalier avec une tendance non significative à une diminution de survie de 4% (OR 0.96 (95% CI, 0.91 to 1.00), P = 0.07) pour chaque augmentation du délai de reconnaissance de 10 secondes.

Dans une seconde partie, nous avons réalisé une étude ancillaire de l'étude DISPATCH (NCT03633370) qui consistait à déterminer, dans les centres de régulation du SAMU inclus dans l'étude, l'impact d'une formation à destination des assistants de régulation médicale sur le délai de reconnaissance téléphonique de l'arrêt cardiaque extrahospitalier au téléphone en régulation médicale. Trente-six bandes audio d'un centre sur les cinq centres inclus dans l'étude ont pu être écoutées. Nous avons montré que la détermination du délai de reconnaissance de l'arrêt cardiaque par double écoute indépendante était faisable.

Les résultats de cette thèse montrent que le délai de reconnaissance est un facteur ayant probablement un lien avec la survie de l'arrêt cardiaque extrahospitalier. Les centres d'appels doivent mettre en œuvre des stratégies de formation et de contrôle qualité afin d'optimiser à la fois le taux et le délai de reconnaissance pour améliorer la survie des patients victimes d'un arrêt cardiaque extrahospitalier.

Mots clés : réanimation cardio-pulmonaire, arrêt cardiaque extrahospitalier, régulation, télécommunication, téléphone

ABSTRACT

The aim of this thesis was to highlight the importance of out of hospital cardiac arrest recognition delay by dispatchers. Dispatcher-assisted cardiopulmonary resuscitation has been reported to increase the rate of survival from cardiac arrest. Reduced delay in CPR initiation is associated with survival and closely linked with cardiac arrest identification.

First, we undertook a systematic review and meta-analysis to assess the effect of OHCA recognition delay by dispatchers on survival after discharge. Of 3664 citations screened, 13 studies were eligible to inclusion. We found a non-significant trend of a 4% relative reduction in survival each time the median time to recognition of OHCA increases by 10 seconds (OR=0.96 (95% CI, 0.91 to 1.00), p=0.07).

Secondly, we conducted an ancillary study to the DISPATCH trial that involves 15 SAMU-Centre 15 (NCT03633370) in a bundle of care including training for dispatchers. We analyzed thirty-six audio recordings of out of hospital cardiac arrest interventions. We demonstrate that double listening of CA audio recording from Centre 15 dispatch center was reliable in majority of cases.

This work suggests that out of hospital cardiac arrest recognition delay could be a prognostic factor of survival. Our findings highlight the benefit for dispatch centers of guideline-based telephone CPR protocols, data collections with call auditing and feedback, and interactive telecommunication training to improve survival of out of hospital cardiac arrests.

Keywords: cardiopulmonary resuscitation, out-of-hospital cardiac arrest, dispatch system, telecommunication, phone

- PART I -

A systematic review and meta-analysis of effects of out-of-hospital cardiac arrest (OHCA) time to recognition by dispatchers on survival after hospital discharge.

ABSTRACT

Background: Dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) has been reported to increase the rate of survival from cardiac arrest. Reduced delay in CPR initiation is associated with survival and closely linked with cardiac arrest identification. The aim of this study was to assess the relationship between out of hospital cardiac arrest (OHCA) recognition delay by dispatcher and survival.

Methods: We undertook a systematic review and meta-analysis to assess the effect of OHCA recognition delay by dispatcher on survival after discharge. The Medline electronic database was searched via PubMed for articles between April 2020 and May 2020. Two reviewers selected primary studies and extracted data. Our report complies with the PRISMA checklist for reporting systematic reviews and QUIPS tool was used to assess the risk of bias in prognostic studies.

Results: Of 3664 citations screened, 13 studies were eligible, totaling 34036 participants. Most of the studies were observational. Four studies were interventional trials. We find a non-significant trend of 4% relative reduction in survival by each 10 seconds increases of the median time to recognition of OHCA (OR=0.96 (95% CI, 0.91 to 1.00), p=0.07). No significant association was found between OHCA time to recognition and survival with favorable neurological outcomes.

Conclusion: Despite extensive data supporting early CPR to improve survival, the results of this meta-analysis find only a non-significant trend toward better survival for reduced time to recognition by dispatchers. Data are scarce to analyze the relationship between time to recognition and favorable neurologic outcome.

Keywords: cardiopulmonary resuscitation, out-of-hospital cardiac arrest, dispatch system, telecommunication, phone

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a significant cause of death worldwide with an estimated survival rate of between 3% and 10% (1,2). The key elements for survival with favorable neurologic outcome include early bystander cardiopulmonary initiation, early defibrillation and optimized post resuscitation care (3). Survival decrease by 7 to 10% for each minute between cardiac arrest and CPR initiation (4). Early bystander CPR is associated with 2-fold survival rate compared with CPR initiated only after EMS arrival on scene (5), as well as an increased survival at hospital discharge with favorable neurological outcome (6–8). Dispatch assisted CPR (DA-CPR), is a way to provide bystander CPR before EMS arrival on scene and is recommended as early as possible to improve survival (9). For dispatch centers, the time between the call and OHCA recognition is a key quality improvement factor to monitor and improve.

The American Heart Association (AHA, 2019) established time limits guidelines for dispatch centers who should not be exceed 90 seconds to OHCA recognition, and 150 seconds to first DA-CPR compression. High performance system should be under 60 and 90 seconds respectively (10).

However, many barriers as agonal breathing, emotional state of the caller, location of the victim or non-experiment dispatcher could prevent an early recognition of the need of CPR (11). This is the reason why the AHA insists on the need of training and providing continuing education in OHCA recognition and DA-CPR for all dispatchers (12).

Although early CPR is associated with better survival, few studies tried to assess the impact of time to recognition delay by dispatchers on clinical outcome. A prompt cardiac arrest recognition by dispatchers could be a key element especially regarding the development of new advanced tools such as geolocalisation phone applications or drone automated defibrillators dispatching on scene. The primary objective of this systematic review and meta-analysis was to investigate the impact of early OHCA recognition on survival at hospital discharge.

METHODS

Study design

This systematic review with meta-analysis was performed according to the current guidelines and complied with the *Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA)* statement (13). The rationale and methods were pre-specified and reported in a protocol registered at PROSPERO.

Eligibility criteria

Types of studies: Eligible primary studies included retrospective or prospective studies of OHCA time to recognition. We also included interventional study that investigate the implementation of a new dispatching protocol.

Participants: To be eligible, primary studies had to enroll adult patients suffering from cardiac arrest outside hospital. We focused on OHCA population only.

Predictor: the pre-specified predictor of interest was OHCA time to recognition by dispatcher. The time for recognition of cardiac arrest was precisely defined as the time between the dispatcher pick up the phone and the dispatcher's identification of the cardiac arrest.

Outcome: The primary outcome was survival at hospital discharge. Additional outcome was survival with favorable neurological outcome.

Favorable neurological status was defined as Pittsburgh cerebral performance categories 1–2.

Language restrictions. Articles published in English or French were included.

Information sources

Studies were identified by searching Medline via PubMed, EMBASE via Ovid, Cochrane Central Register of Controlled Trials (CENTRAL), Current content, Pascal and Open Sigle with no year

restrictions. Our electronic search was supplemented by screening the reference lists of the retrieved original articles and of previously published review articles to identify additional studies.

Search strategy

The Medline search strategy was developed by two members from the project team and critically reviewed by a third expert. The search concepts included OHCA and time to recognition. We used both standardized medical subject heading (MeSH) and text words (Appendix 1). No document restrictions were applied, and no methodology filters were used. The search was limited to studies involving humans.

Study selection

Data management. The literature search results were uploaded along with titles and abstracts into reference management software. Duplicate publications reporting data from the same study were identified by comparing author names, study sites and sample sizes.

Selection process. Two review authors (NV and AL) independently screened citation titles and abstracts, where available, yielded by the literature search against pre-specified eligibility criteria. The screening process assessed whether the citation 1) reported data from an original research study, 2) focused on OHCA, 3) investigated OHCA time to recognition 4) evaluated survival at hospital discharge. The two review authors rated each citation using a “relevant”, “irrelevant” or “unsure” designation. Full-text articles were retrieved for citations that received a “relevant” or “unsure” classification from at least one of the two review authors. Records rated “irrelevant” by the two review authors were set aside for further review.

The two review authors independently assessed full-text articles and decided if they met pre-specified eligibility criteria, using a standardized eligibility form. Disagreements were resolved by discussion between the two review authors. The reasons for excluding studies were recorded.

Additional records were identified by checking reference lists of retrieved studies or contacting field experts.

Data collection

A review author (AL) performed qualitative and quantitative data extraction, using a standardized form. Another review author (NV) checked the extracted data for accuracy. Disagreements were resolved by discussion between the two review authors. When possible, aggregate data were extracted from published articles. Studies with insufficient information on outcome data were excluded from the meta-analysis.

Data items

Extracted data were collated in a single meta-analysis database, including a primary study identifier, first author last name, publication year, country of study sites, enrolment period, study design, number of participants included in the meta-analysis, patient gender and age, OHCA location, OHCA time to recognition by dispatcher, time to initiate dispatcher assisted CPR, time to EMS arrival, and rates of OHCA witnessed, initiated bystander CPR, and initial shockable rhythms. Survival to admission, to discharge, and favorable neurological outcomes were also extracted.

Risk of bias assessment

The two review authors independently appraised the methodological quality of the studies included for each predictor of interest, using a checklist adapted from the Quality in Prognosis Studies (QUIPS) tool (14). The QUIPS tool comprises six bias domains including participation,

attrition, prognostic factor measurement, outcome measurement, confounding, and statistical analysis and reporting. For each domain, responses to prompting items inform the judgment of risk of bias. Disagreement in risk of bias between the two review authors were resolved by discussion.

Statistical analysis

We performed a meta-analysis of single proportion point estimates from primary studies, after logit transformation. For this purpose, we used the DerSimonian and Laird's random-effects meta-analysis model to combine weighted logit-transformed proportions along with the corresponding standard errors. Results (effect on survival at discharge) are expressed by 10s increment delays.

Primary studies in forest plots were stratified according to median time to OHCA recognition. Three subgroups were defined, namely <60 s, [60 s to 120 s], and ≥ 120 s. Summary meta-analytical estimates were back-transformed in the original probability scale, using the inverse of the logit function. Between-study heterogeneity was evaluated graphically by examining forest plots and statistically by using the I^2 inconsistency index. The I^2 index provides an estimate of the percentage of total variance across studies due to heterogeneity rather than chance. An I^2 index of 0% indicates no evidence of heterogeneity and higher values reflect increasing heterogeneity.

To further investigate the relationship between median time to OHCA recognition and logit-transformed survival proportion at discharge, we performed random-effect meta-regression. The fitted regression line was displayed together with circles representing the estimates derived from each primary study, sized according to the inverse of within-study variance.

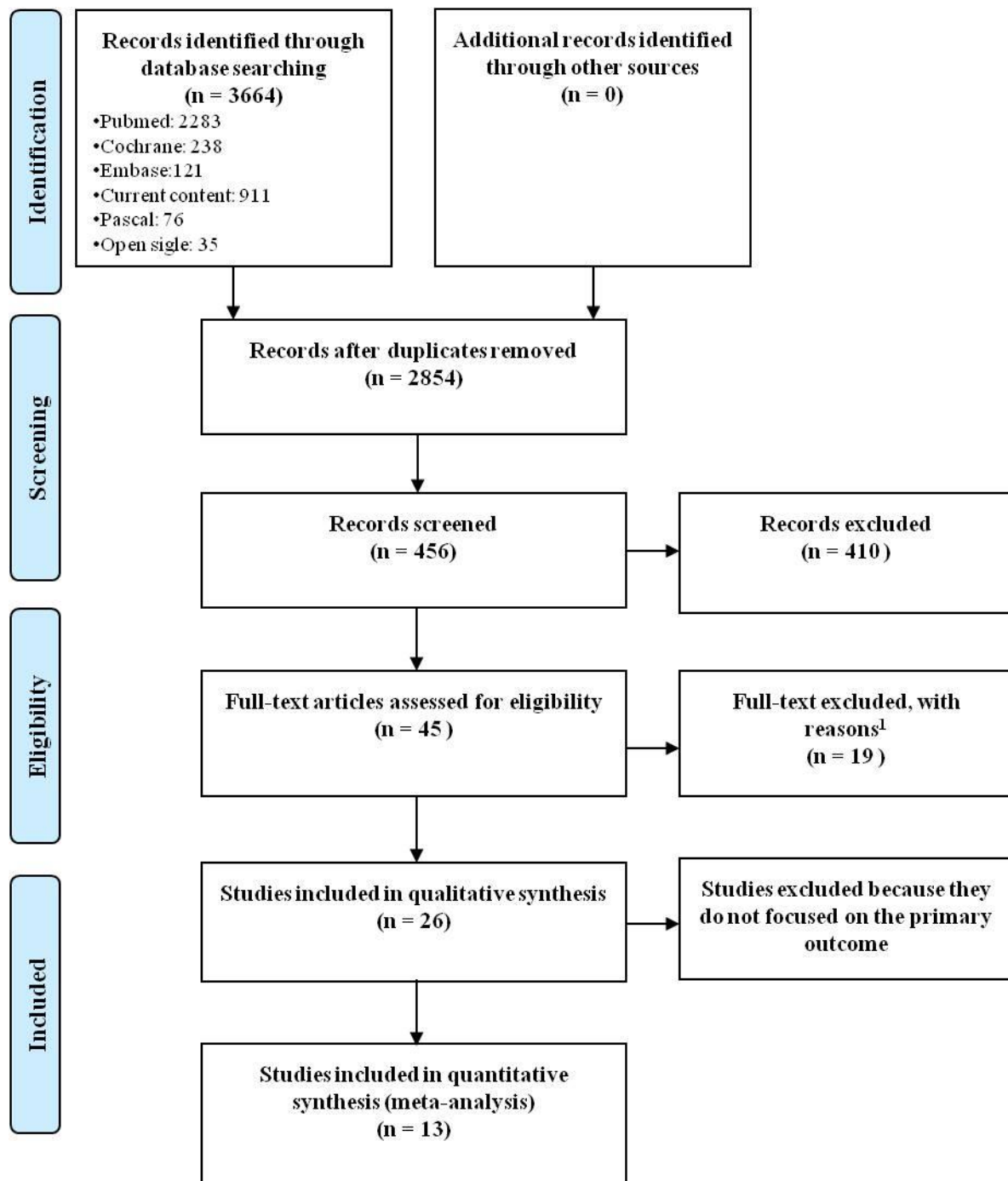
Two-sided p -values of less than 0.05 were considered statistically significant. All analyses were performed using Stata SE 14 (Stata Corp, College Station, TX, USA).

RESULTS

Study selection

A total of 3664 records were identified through database searching (Figure 1). After removing 810 duplicates, the titles and abstracts for 2854 records were screened for eligibility. Of these, 45 records were identified as being potentially relevant and full-text articles were retrieved for more thorough review. After excluding 32 records based on full-text articles, our systematic review included 13 primary studies including 34 036 patients.

Figure 1. Flow Diagram of the selection process



¹Reasons for exclusion:

- No OHCA recognition time reported in the study n = 13
- Not published studies or only as abstract n = 4
- Citations reporting data already included in other studies n = 2

Study characteristics

Study characteristics are described in the Table 1, and detailed inclusion criteria of studies in the Supplementary material 1. Study enrolment periods extended from 2000 to 2020. Six studies were conducted in North America, 3 in Asia, and 4 in Europe. The overall crude survival rate to hospital discharge in all the studies was 11.1% (3767 survivors of 34 036 cases of OHCA). 10 of the 13 studies included were observational (5 retrospective cohort studies, 1 prospective cohort study, 4 retrospective before-after studies and 2 cross-sectional studies), and 3 were interventional.

Table 1. Characteristics of studies included in the analysis

Characteristics of the studies	N = 13
Publication	Resuscitation (n= 7) JAMA (n=1) Circulation (n=1) JAHA (n=1) Annals of Emergency Medicine (n=1) Journal of Emergency Medicine (n=1) Journal of Academic Emergency Medicine (n=1)
Years of publication	2003 2007 2011 2013 2015 2016 (n=2) 2017 (n=3) 2018 (n=2) 2020
Type of studies	Observational (Cross sectional, Prospective and Retrospective cohort) (n=10) Interventional (n=3)
Country	United States (n=5) Taiwan (n=1) South Korea (n=2) France (n=1) Switzerland (n=1) Canada (n=1) Czech Republic (n=1) Norway (n=1)

Patient characteristics

The median age ranged from 62 yo to 73 yo. Of the 13 included studies, 8 were conducted in the adult population only (excluding patient under 18 years old in 4 studies, and respectively 19, 17, 16, 14 in the others), five included both adults and children. The proportion of males ranged from 57.9% to 72%, and the proportion of OHCA occurring at home ranged from 65% to 96.4%. Data analyzed are detailed in Table 2.

Table 2. Data analyzed

Author, year	Bobrow et al., 2016 ⁽¹⁵⁾		Bradley et al., 2011 ⁽¹⁶⁾		Dami et al., 2015 ⁽¹⁷⁾		Derkenne et al., 2019 ⁽¹⁸⁾		
Type of publication	Prospective before-after observational		Prospective cohort		Retrospective observational		Retrospective cross-sectional		
Country	United States, Arizona, Phoenix		United States, Washington, King County		Switzerland, State of Vaud		France, Paris		
Years of inclusion	October 1st 2010-September 30th 2013		June 1st 2004-October 1st 2008		January 1st 2011-December 31st 2013		2012 (15-31 November)	2015 (26 January to 09 February)	2017 (1-15 October)
Study arm	Before implementation	After implementation	Limited English caller	Fluent English caller	All OHCA included	OHCA recognized by dispatcher	First cross sectional	Second cross sectional	Third cross sectional
No of patient in each group	798	1536	57	914	1254	895	69	85	48
OHCA recognition delay in sec (median time, IQR)	111	99.5	84 (49-178)	50 (30-82)	/	60 (33-148)	168 (128-206) °°	164	211
DACPR delay in sec (median time, IQR)	205	179	237 (164-333)	163 (119-217)	/	/	230 (208-330) °°	260	356
First compression in sec (median time, IQR)	256	212	/	/	/	220 (138-347)	/	/	/
Time to EMS arrival (min)	5 (1-604) *	5 (1-166) *	6 (4-7) **	5 (4-7) **	13.3 (45.5) §	14.0 (52.8) §	/	/	/
Male gender, n (%)	512 (64.2)	987 (64.3)	33 (57.9)	607 (66.4)	854 (68,1)	605 (67,6)	45 (65)	49 (60)	30 (63)
Age, (median; range)	63 (14-99)	63 (9-101)	61.6 (16.4) §	61.7 (16.1) §	68.5 (15.2) §	65.0 (17.4) §	65 (51-79) **	71 (58-84) **	66 (55-81) **
Location Home, n (%)	713 (89.3)	1339 (87.2)	54 (96.4)	837 (91.6)	/	/	45 (65)	65 (79)	41 (85)
Witnessed, n (%)	258 (32.3)	480 (31.3)	28 (49.1)	456 (50.0)	/	/	/	/	/
Bystander CPR n (%)	493 (61.8)	1026 (66.8)	36 (64.3)	702 (77.5)	487 (38.8) °	487 (54.4) °	25 (36)	51 (62)	35 (73)
Initial shockable rhythm, n (%)	170 (21.3)	306 (19.9)	19 (33.3)	331 (36.2)	217 (17.3)	168 (18.8)	15 (22)	15 (18.3)	14 (28)
Survival to admission, n (%)	455 (57.0)	876 (57.0)	18 (32.1)	352 (39.2)	282 (22.5)	194 (21.8)	19 (28)	21 (26)	17 (35)
Survival to discharge, n (%)	73 (9.1)	184 (12.0)	5 (8.8)	151 (16.5)	87 (6.9)	59 (6.6)	5 (7)	3 (4)	4 (8)
Discharge alive with favorable neurological outcomes, n (%)	45 (5.6)	127 (8.3)	/	/	79, (6,9)	53 (6,5)	/	/	/

*: median (range) ° including CPR before DA CPR

** : median (IQR) °°: 95% CI

§: mean (SD)

Author, year	Derkenne et al., 2019 ⁽¹⁸⁾	Fukushima et al., 2017 ⁽¹⁹⁾			Hardeland et al., 2017 ⁽²⁰⁾		Hauff et al., 2003 ⁽²¹⁾	Huang et al., 2017 ⁽²²⁾	
Type of publication	Retrospective cross-sectional	Retrospective Observational			Prospective, interventional		Retrospective cohort	before-after interventional	
Country	France, Paris	United States, Arizona			Norway		United States, Whashington	Taiwan, Taoyuan City	
Years of inclusion	2018 (1-30 November)	October 1st 2010-December 31st 2014			January 28th 2013- January 31st 2014	May 14th- December 31st 2014	July 1st 2000-June 30th 2002	Nov 2014 - Aug 2015	Sep 2015 - Feb 2016
Study arm	Fourth cross sectional	All OHCA included	Description of abnormal breathing arm	No description of abnormal breathing arm	Before intervention	After intervention		Before intervention	After intervention
No of patient in each group	122	2411	379	1462	331	230	404	66	64
OHCA recognition delay in sec (median time, IQR)	210 (164 ;285) °°	/	118.5	73.5	84 (72 ; 102) °°	78 (66 ; 96) °°	50 (31-94)	37.5 (25.3) §	32.8 (23.9) §
DACPR delay in sec (median time, IQR)	339 (256 ;454) °°	/	203.5	155.5	156 (138 ; 186) °°	138 (126 ; 150) °°	63	70.4 (38.0) §	83.5 (40.9) §
First compression in sec (median time, IQR)	/	/	242	197.5	198 (174 ; 216) °°	168 (150 ; 186) °°	236 (194-292)	173.8 (111.5) §	180.5 (50.9) §
Time to EMS arrival (min)	/	/	/	/	9 (8 ; 10) °°	8 (8 ; 9) °°	6 (4-7) **	/	/
Male gender, n (%)	71 (57)	1570 (65,1)	/	/	220 (67)	163 (71)	291 (72.0)	44 (66.7)	46 (71.9)
Age, (median; range)	70 (55-81) **	62 (0-101)	/	/	67 (65 ; 69) °°	67 (64 ; 69) °°	68 (56-79) **	69.9 (19.15) §	65.4 (16.42) §
Location Home, n (%)	99 (81)	2136 (88.6)	/	/	225 (68)	162 (70)	324 (80.3)	/	/
Witnessed, n (%)	/	769 (31.9)	/	/	212 (64)	148 (64)	231 (57.1)	/	/
Bystander CPR n (%)	101 (83)	1330 (55.2)	/	/	248 (75)	183 (80)	238	24 (36.4)	32 (50.0)
Initial shockable rhythm, n (%)	32 (26)	566 (23.5)	/	/	77 (23.2)	57 (24.8)	208 (51.5)	/	/
Survival to admission, n (%)	32 (26)	1401 (58.1)	/	/	111 (34)	80 (35)	143 (35.4)	13 (19.7)	16 (25.0)
Survival to discharge, n (%)	9 (7)	262 (10.9)	/	/	61 (18)	32 (14)	63 (15.6)	2 (3.0)	7 (10.9)
Discharge alive with favorable neurological outcomes, n (%)	/	177 (7.3)	/	/	/	/	/	/	/

*: median (range) ° including CPR before DA CPR

** : median (IQR) °° : 95% CI

§ : mean (SD)

Author, year	Ko et al., 2018 ⁽²³⁾	Lewis et al., 2013 ⁽²⁴⁾	Park et al., 2018 ⁽²⁵⁾		Plodr et al., 2016 ⁽²⁶⁾		Vaillancourt et al., 2007 ⁽²⁷⁾	
Type of publication	Cross-sectional	Retrospective cohort	Before after Interventional		Retrospective cohort		Observational retrospective before-after	
Country	Korea	United States, Washington, King County	South Korea, Seoul		Czech Republic, Hradec Kraloveregion		Canada, Ottawa	
Years of inclusion	January 2013-December 2016	January 1st 2011-December 31st 2011	January 2013-December 2014	January 2015-December 2016	January 1st 2015-September 30th 2015		July 1st 2003-December 31st 2004	
Study arm			Before intervention	After intervention	Before implementation	After implementation	Before implementation	After implementation
No of patient in each group	11833	476	6201	6469	152	174	295	234
OHCA recognition delay in sec (median time, IQR)	123 (80-184)	75 (47-121)	120 (83-182)	142 (106-196)	46 (29-80)	37 (18-68)	/	158
DACPR delay in sec (median time, IQR)	/	85 (58-141)	/	/	80 (54-138)	76 (50-128)	/	188
First compression in sec (median time, IQR)	/	176 (141-242)	/	/	155 (116-221)	145 (106-207)	/	237
Time to EMS arrival (min)	/	6.1 (3.0) §	5 (4-7) **	6 (4-7) **	8:23 (3:58) §	8:04 (4:25) §	6:34	6:43
Male gender, n (%)	7501 (63.4)	309 (64.9)	3974 (64.1)	4125 (63.8)	97 (63.8)	113 (64.9)	185 (62.7)	168 (71.8)
Age, (median; range)	72 (58-81) **	63.7 (16.7) §	72 (58-80) **	73 (59-81) **	66 (19.5) §	63.1 (19.4) §	68.6 (20-94)	68.0 (18-94)
Location Home, n (%)	8847 (74.8)	400 (84.0)	4913 (79.2)	5117 (79.1)	112 (73.4)	125 (71.2)	/	/
Witnessed, n (%)	/	234 (49.2)	3082 (49.7)	3116 (48.2)	/	/	141 (47.8)	124 (53.0)
Bystander CPR n (%)	9665 (81.7)	295 (62)	3462 (55.8)	3943 (61)	/	/	49 (16.7)	84 (35.9)
Initial shockable rhythm, n (%)	1936 (16.4)	139 (29)	696 (11.2)	719 (11.1)	31 (20.4)	31 (17.8)	76 (27.4)	73 (33)
Survival to admission, n (%)	/	205 (43.1)	/	/	39 (25.7)	57 (32.8)	30 (10.2)	22 (9.5)
Survival to discharge, n (%)	1380 (11.7)	102 (21.4)	594 (9.6)	707 (10.9)	17 (11.2)	26 (14.9)	14 (4.8)	7 (3.0)
Discharge alive with favorable neurological outcomes, n (%)	945 (8.0)	95 (20)	334 (5.4)	441 (6.8)	11 (7.2)	18 (10.3)	/	/

*: median (range) ° including CPR before DA CPR

** : median (IQR) °° : 95% CI

§ : mean (SD)

Risk of bias assessment and analysis

All studies fulfilled four or more QUIPS tool criteria (Supplementary material 2).

Four studies yielded moderate risk of bias for study participation, and the 9 other were classified as high risk of bias. Only 2 studies yielded moderate risk of bias for study attrition, 7 other yielded high risk of bias, and 3 were not concerned by this criterion. Indeed, some studies did not report the duration of follow-up or how they dealt with missing data.

Regarding risk of bias for predictor measurement, only 6 studies had a valid and reliable measurement of prognostic factor. Regarding risk of bias for outcome measurement, 3 studies had a high risk of bias because of lack of valid outcome measurement. The risk of confounding bias was considered high for 6 studies due to the lack of appropriate adjustment. The majority did not adjust for potential confounding variables.

Recognition delay and survival to discharge

Survival at discharge was assessed in all studies included. Using a random effects model, we find a non-significant trend of a 4% relative reduction in survival each time the median time to recognition of OHCA increases by 10 seconds: OR = 0.96 (95% CI, 0.91 to 1.00), p=0.07.

These results are also suggested by the stratified analysis on the timeframe in 3 categories: 14% of survival for the <60 sec recognition delay subgroup, 13% of survival for the 60 to 120 sec recognition delay subgroup, and 10% of survival for the >120 sec recognition delay subgroup (Figure 2).

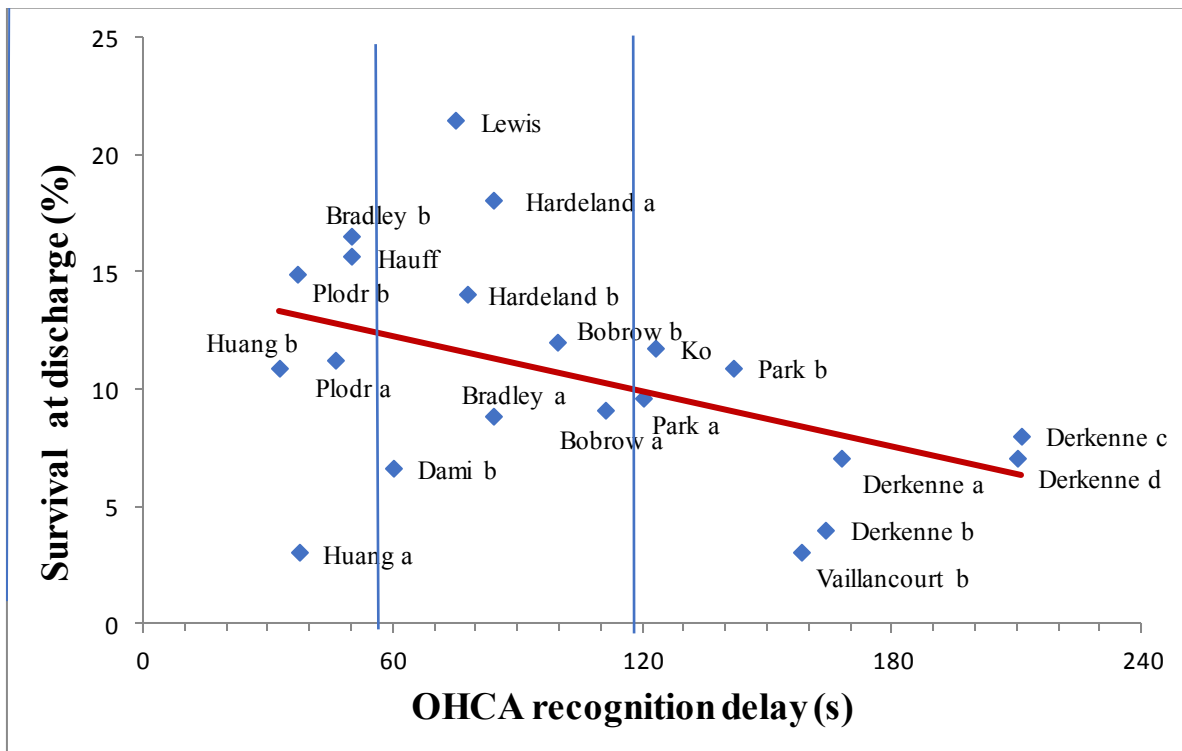
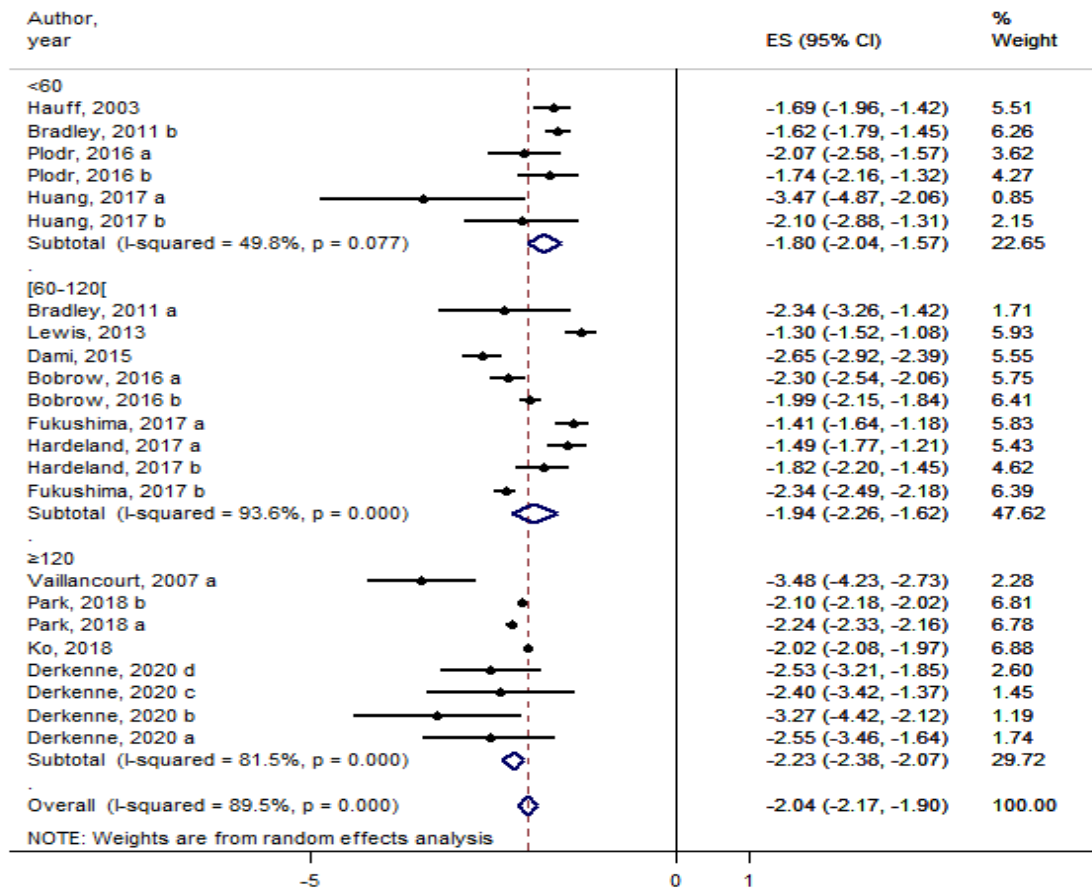


Figure 2. Survival by median time to OHCA recognition delay in each study

Recognition delay and favorable neurological outcomes

Survival with favorable neurological outcomes at hospital discharge (Cerebral Performance Category 1 or 2) was assessed only in 4 studies (Figure 3). There was no significant association between OHCA recognition delay and rate of survival with favorable neurological outcomes (OR = 1.01 (95% CI, 0.91 to 1.12), p=0.79).

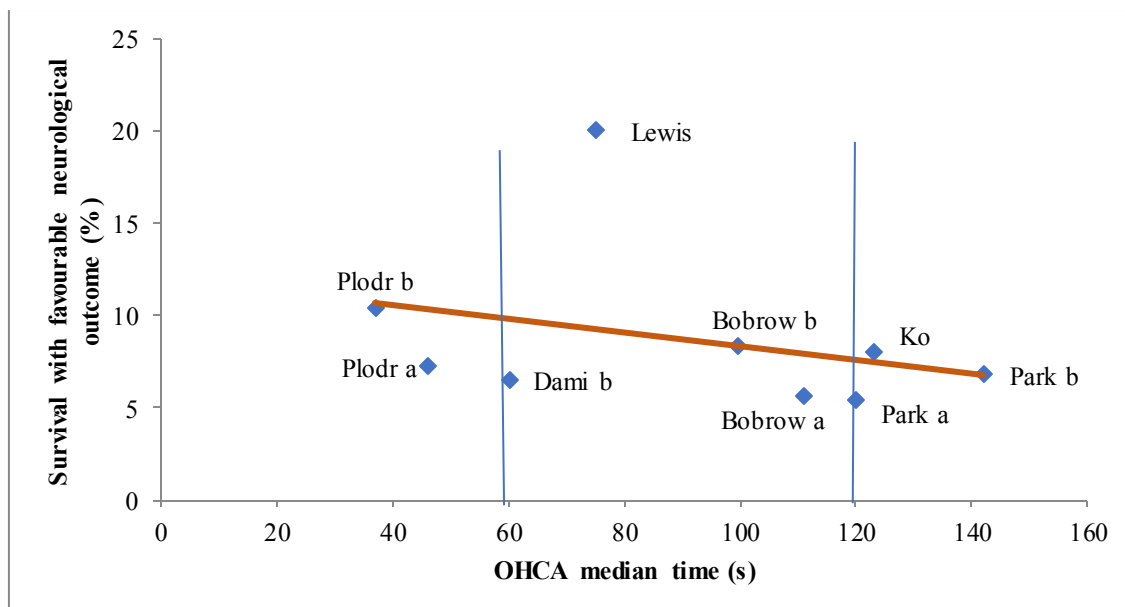
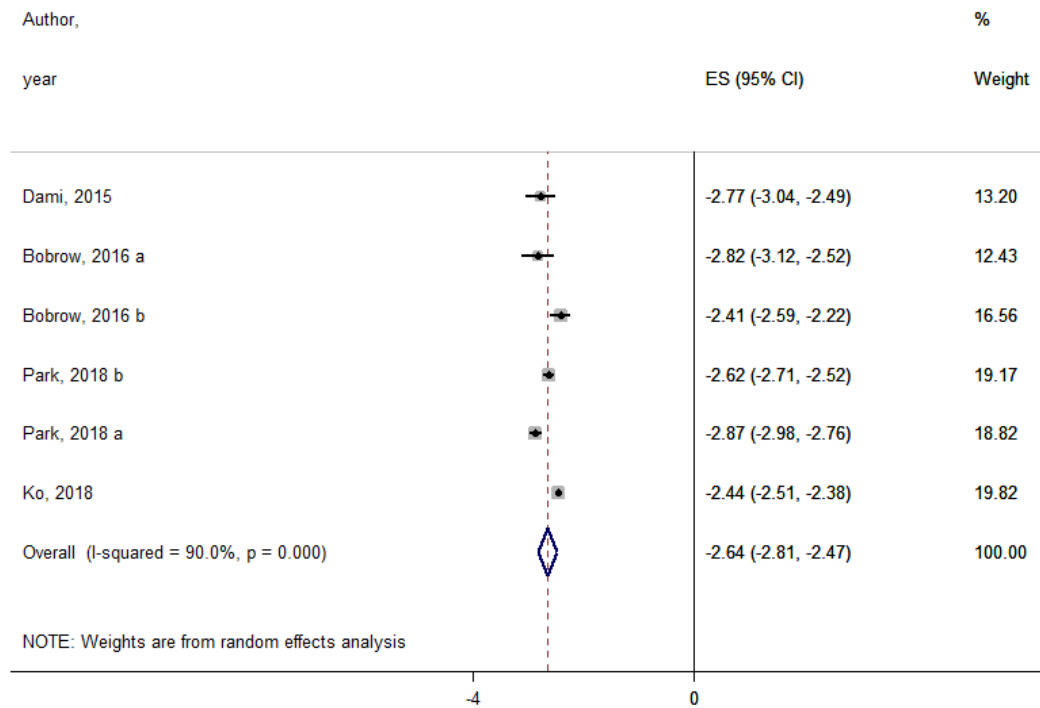


Figure 3. Survival with favorable neurologic outcomes at discharge by median time to OHCA recognition in each study

DISCUSSION

To our knowledge, this is the first meta-analysis to investigate the relationship between OHCA time to recognition by EMS dispatchers and clinical outcomes. Our meta-analysis explores an important organizational and training strategy for EMS agencies and is consistent with the International Liaison committee on Resuscitation (ILCOR) regarding strategies for optimizing the chain of survival.

Our results show a trend towards a relative decrease in survival of 4% (OR 0.96; 95% CI [0.91; 1.00]; $p = 0.07$) for every 10-second increase in the median time to recognition of cardiac arrest by the dispatcher. Surprisingly, despite clear association between early CPR and survival for OHCA (28–30) and the potential association between early dispatcher recognition and earlier dispatch-assisted CPR, the results did not reach statistical significance. This can be explained by the heterogeneity of the included studies, concerning the inclusion and exclusion criteria, the definitions of the outcomes, the inclusion periods, the size of the population and the lack of randomized controlled trial on this subject. Indeed, although our analysis includes American, European and Korean studies, two-thirds of the total number of patients analyzed were Korean (24,503 / 34036). It should also be noted that despite the recommendations based on Utstein's model, pre- and intra-hospital care as well as dispatching systems differ from one country to another.

Since the 1980s, the time to on scene arrival by the Emergency Medical Services (EMS) teams is one of the prognostic factors associated with better survival. Before 2007, only EMS had an AED and could then deliver early defibrillation. A shockable rhythm is accessible to defibrillation, if it is performed early, and increases the chances of survival by 50 to 70% (28,29). It is estimated that upon early recording of cardiac activity, the percentage of VF rises to 76% (29,30).

Since the development of training courses and public awareness campaigns on performing CPR, the time to completion of CPR has emerged as the most important prognostic factor explained by decrease by 7 to 10% of survival for each minute between cardiac arrest and CPR initiation (4). Hasselqvist-Ax and al. (31) found that Early bystander CPR is associated with 2 fold 30-days survival rate compared with CPR initiated only after EMS arrival on scene (5). However, studies converge on the fact that the rate of CPR spontaneously undertaken by witnesses is extremely low, and the quality is difficult to objectivize.

In recent years, the management of out-of-hospital cardiac arrest has been revolutionized by two new approaches: CPR by telephone assisted witness by the dispatcher, which has shown a positive impact on survival (8,32–34), and also the deployment of new technologies such as phone applications for alerting a volunteer rescuer present near the site of the cardiac arrest (34). In this context, the effectiveness of such care depends on the dispatcher, the first link in the survival chain from the very first seconds, justifying the delay in recognition of OHCA as a potential prognostic factor.

Time to cardiac arrest recognition seems to be highly affected by the training program and dispatch protocols used by EMS agencies. Several studies showed an improvement in the proportion of cardiac recognized by dispatcher (32,35). Most of the assessment criteria focused on cardiac arrest recognition. Nevertheless, time to recognition can be very different between dispatch protocols. For example, a dispatch training program and protocol was able to increase cardiac arrest recognition from 54% to 84% but was associated with an increased time to OHCA recognition and starting t-CPR delivery (35). On the other hand, the use of a no-no-go protocol in Arizona was associated with an increase of DA-CPR and decrease in time to dispatch recognition. Therefore, in addition to the cardiac arrest recognition by dispatch, time to recognition should also be clear recorded as key quality indicator for EMS agencies. Dispatcher training and quality improvement of dispatch center should focus on cardiac arrest proportion and

time to recognition in cardiac arrest. Implementation of "bundles of care" seems to be associated with better results (36).

The development of artificial intelligence in many branches of medicine, including the field of dispatching could also provide an effective way to improve cardiac arrest time to recognition. Blomberg et al. (37) demonstrated a higher sensitivity and a lower recognition time of OHCA by the AI compared to the dispatcher: the machine learning framework had a significantly higher sensitivity (72.5% vs. 84.1%, $p < 0.001$) with lower specificity (98.8% vs. 97.3%, $p < 0.001$) and time-to-recognition was significantly shorter for the machine learning framework compared to the dispatchers (median 44 seconds vs. 54 s, $p < 0.001$).

This meta-analysis included 11 primary studies that have been completed since 2010, summarizing the most recent evidence available on OHCA time to recognition by dispatchers on survival after hospital discharge. However, this meta-analysis has a few caveats that must be considered.

Firstly, despite the template proposal and performance standards for OHCA dispatch studies proposed by some authors (17,24), there is a great deal of heterogeneity among the various studies included (Supplementary materials 1) justifying a cautious interpretation of the results. We did not have access to individual data from the included studies, which prevented the implementation of consistent inclusion and exclusion criteria, the standardization of outcome definitions in the primary studies, and the treatment of missing data. However, the reluctance of researchers to share raw data is the main obstacle to conducting a meta-analysis of participants' individual data, although it is considered a more reliable approach than meta-analysis of aggregate data.

Secondly, our inclusion includes 10 observational studies, 8 of which are retrospective. These studies have a low level of evidence and, unlike randomized controlled trials, are subject to

confounding and selection bias. However, the objective of our study was to study prognostic factors (survival and good neurological outcome) according to recognition delay, and this objective cannot be addressed by randomized controlled trials.

Finally, the fact that we were not able to perform a multivariate pooled analysis taking into account the known factors of OHCA survival is the main drawback of this study. Future analyzes should take advantage of individual data.

CONCLUSION

We undertook a systematic review and meta-analysis to assess the effect of OHCA recognition delay by dispatchers on survival after discharge. Based on the 13 studies included, we found a non-significant 4% decrease of survival each 10 seconds increase of the recognition delay of the out-of-hospital cardiac arrest. Despite the need for future research addressing prospectively the specific association between OHCA recognition delay and survival, this work suggests that out of hospital cardiac arrest recognition delay is a prognostic factor of survival.

ACKNOWLEDGMENTS

This research has received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. Any sponsor was not involved in the study protocol development and did not have any role in the conduct of the meta-analysis and interpretation, or publication of the results.

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SUPPELMENTARY MATERIALS

Supplementary materials 1. Study characteristics

Exclusion criterion	Bobrow	Bradley	Dami	Derkenne	Fukushima	Hardeland	Hauff	Huang	Ko	Lewis	Park	Plodr	vaillancourt
Age under 18	NO	YES	YES	NO	NO	NO	YES	YES	NO (19 yo)	NO (17 yo)	NO (15 yo)	NO	NO (16 yo)
Traumatic OHCA	YES	YES	YES	NO	YES	NO	YES	YES	YES	YES	YES	NO	YES
Nursing facilities	YES	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO	NO	NO
EMS witnessed	YES	YES	YES	/	YES	/	YES	YES	YES	YES	YES	YES	YES
Hypoxic etiology	NO	YES	/	NO	NO	NO	YES	NO	YES	NO	YES	NO	YES
Obvious do not resuscitate	YES	YES	*	NO	YES	YES	*	YES	NO	NO	NO	NO	YES
No EMS treated	YES	YES	YES	/	YES	YES	YES	YES	YES	YES	YES	YES	YES
CPR initiated before call	YES	YES	*	YES	*	YES	*	NO	YES	*	NO	YES	NO
Incomplete recording file	*	/	YES	YES	*	YES	YES	YES	NO	YES	/	YES	NO
Caller Not on site	/	/	YES	YES	YES	YES	/	YES	YES	*	NO	YES	NO
Data included for OHCA recognition delay analysis													
All OHCA	YES	NO	NO	/	YES	YES	NO	YES	NO	NO	YES	NO	YES
Only OHCA recognized by dispatchers	NO	YES	YES	/	*Only recognizable OHCA	NO	YES (only when DA CPR was offered)	NO	YES (only when witnessed and DA CPR)	Only OHCA recognized	NO	YES (only OHCA recognized)	NO
Key characteristics													
Age	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Gender	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Location	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	NO
Witnessed	YES	YES	YES	NO	YES	YES	YES	NO	/	YES	NO	NO	YES
Bystander CPR	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	* all inclusions	NO
Initial shockable rhythm	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES





* only excluded for OHCA recognition delay analysis

Yo = years old

Supplementary material 2. Risk of bias assessment following QUIPS tool

	<u>QUIPS tool item</u>	Bobrow	Bradley	Dami	Derkenne	Fukushima	Hardeland	Hauf	Huang	Ko	Lewis	Park	Plodr	Vaillancourt
Study Participation	Source of target population													
	Method used to identify problem													
	Inclusion and exclusion criteria													
	Adequate study participation													
	Baseline characteristics													
	All OHCA assess for delay													
	Same exclusion criterion													
Study attrition	Proportion of baseline sample available													
	Information on participants who dropped out													
	Reasons of subjects lost to follow up													
	Information on subjects lost to follow up													
Prognostic Factor Measurement	Definition of the PF													
	Valid and reliable measurement of PF													
	Method of PF measurement													
	Proportion of data on PF available													
	Method used for missing data													
	Method used for missing data													
Outcome Measure	Definition of the Outcome													
	Valid measurement of Outcome													
	Method of Outcome Measurement													
Study Confounding	Important Confounders measured													
	Important Confounders measured													
	Important Confounders measured													
	Important Confounders measured													
	Definition of the confounding factor													
	Method of Confounding Measurement													
	Appropriate accounting for confounding													

Key:

	Low risk of bias
	Unclear risk of bias
	High risk of bias
	Not applicable

Biases	Issues to consider for judging overall rating of “Risk of bias”	Judgement	
		YES	NO
1. Study Participation	Goal: To judge the risk of selection bias		
<i>Source of target population</i>	The source population or population of interest is adequately described for key characteristics		
<i>Method used to identify problem</i>	The sampling frame and recruitment are adequately described, possibly including methods to identify the sample, place of recruitment, and period of recruitment		
<i>Inclusion and exclusion criteria</i>	Inclusion and exclusion criteria are adequately described		
<i>Adequate study participation</i>	There is adequate participation in the study by eligible individuals		
<i>Baseline characteristics</i>	The baseline study sample is adequately described for key characteristics		
Summary Study Participation	The study sample represents the population of interest on key characteristics, sufficient to limit potential bias of the observed relationship between the prognostic factor and outcome		
2. Study Attrition	Goal: To judge the risk of attrition bias		
<i>Proportion of baseline sample available for analysis</i>	Response rate is adequate and is > 80%		
<i>Attempts to collect information on participants who dropped out</i>	Attempts to collect information on participants who dropped out of the study are described		
<i>Reasons and potential impact of subjects lost to follow up</i>	Reasons for loss to follow up are described		
<i>Outcome and prognostic factor information on those lost to follow up</i>	Participants lost to follow up are adequately described for key characteristics		
	There are no important differences between key characteristics and outcomes in participants who completed the study and those who did not		
Summary Study Attrition	Loss to follow-up is not associated with key characteristics sufficient to limit potential bias to the observed relationship between the prognostic factor and the outcome		
3. Prognostic Factor Measurement	Goal: To judge the risk of measurement bias related to how the prognostic factor was measured		
<i>Definition of the PF</i>	A clear definition or description of the prognostic factors is provided		
<i>Valid and reliable measurement of PF</i>	Method of prognostic factor measurement is adequately valid and reliable to limit misclassification bias		
	The prognostic factors measured are blinded for outcome measure		
	Continuous variables are reported or appropriate cut-offs are used		
<i>Method and setting of PF measurement</i>	The method and setting of measurement of PF is the same for all study participants		
<i>Proportion of data on PF available for analysis</i>	More than 80% of the study sample has completed data for PF variable		
<i>Method used for missing data</i>	Appropriate methods of imputation are used for missing ‘PF’ data		
PF Measurement Summary	PF is adequately measured in study participants to sufficiently limit potential bias		
4. Outcome Measurement	Goal: To judge the risk of bias related to the measurement of outcome		
<i>Definition of the Outcome</i>	A clear definition of the Outcome is provided		
<i>Valid and reliable measurement of Outcome</i>	The method of outcome measurement used is valid and reliable to limit misclassification bias		
<i>Method and setting of Outcome Measurement</i>	The method and setting of outcome measurement is the same for all study participants		
Outcome Measurement Summary	Outcome of interest is adequately measured in study participants to sufficiently limit potential bias		
5. Study Confounding	Goal: To judge the risk of bias due to confounding		
<i>Important Confounders measured</i>	All important confounders are measured		
<i>Definition of the confounding factor</i>	Clear definitions of the important confounders measured are provided		
<i>Method and setting of Confounding Measurement</i>	The method and setting of confounding measurement are the same for all study participants		
<i>Appropriate accounting for confounding</i>	Important potential confounders are accounted for in the study design		
	Important potential confounders are accounted for in the analysis		
Study Confounding Summary	Important potential confounders are appropriately accounted for, limiting potential bias with respect to the relationship between PF and outcome		
6. Statistical Analysis and Reporting	Goal: To judge the risk of bias related to the statistical analysis and presentation of results		
<i>Presentation of analytical strategy</i>	There is sufficient presentation of data to assess the adequacy of the analysis		
<i>Model development strategy</i>	The strategy for model building is appropriate and is based on a conceptual framework or model.		
	The selected statistical model is adequate for the design of the study		
<i>Reporting of results</i>	There is a description of the association of the prognostic factor and the outcome, including information about the statistical significance		
	Continuous variables are reported or cut-off points are used		
	There is no selective reporting of results		
Statistical Analysis and Reporting Summary	The statistical analysis is appropriate for the design of the study, limiting potential for presentation of invalid or spurious results		

APPENDIX 1. Detailed research methodology

PubMed

Key words : “cardiac arrest”, “heart arrest”, “cardiopulmonary resuscitation”, phone, telephone, telecommunication*, hotline*, communication, dispatch, telemedicine

Equation : (((“cardiac arrest”[Title/abstract]) OR (“heart arrest”[MeSH Terms]) OR (“cardiac arrest”[Other Term]) OR (“cardiopulmonary resuscitation”[Title/abstract]) OR (“CPR”[Title]) OR (“cardiopulmonary resuscitation”[Other Term]) OR (“cardiopulmonary resuscitation”[Mesh])) AND ((phone[Title/Abstract]) OR (telephone[Title/Abstract]) OR (telecommunications [Mesh]) OR (hotline*[Title/Abstract]) OR (Hotlines [Mesh]) OR (communication*[Title/Abstract]) OR (communication[Mesh]) OR (dispatch*[Title/abstract]) OR (“Telemedicine”[Mesh])))

Embase

Key words : “cardiac arrest”, “heart arrest”, “cardiopulmonary resuscitation”, phone, telephone, telecommunication*, hotline*, communication, cell phone, telemedicine

Equation : (“cardiac arrest”:ti,ab,kw OR MeSH descriptor:[Heart Arrest] OR “cardiac arrest”:ti,ab,kw OR “cardiopulmonary resuscitation”:ti,ab,kw OR “CPR”:ti OR MeSH descriptor: [Cardiopulmonary Resuscitation]) AND ((phone):ti,ab,kw OR (telephone*):ti,ab,kw OR (hotline*):ti,ab,kw OR (communication):ti,ab,kw OR (dispatch*):ti,ab,kw OR (MeSH descriptor: [Hotlines]) OR (MeSH descriptor: [Communication]) OR (MeSH descriptor: [Telemedicine]) OR (MeSH descriptor: [Telecommunications]) OR (“cell phone”):ti,ab,kw)

Pascal

Key words : “cardiac arrest”, “heart arrest”, “cardiopulmonary resuscitation”, CPR, “Out Of Hospital”, “cardiopulmonary resuscitation training”, phone, telephone, telecommunication*, hotline, communication, dispatch*, telemedicine

Equation : ((kw.*:(“Heart arrest”) OR ti.*:(“cardiac arrest”) OR kw.*:(“Cardiopulmonary Resuscitation”) OR kw.*:(“CPR”) OR kw.*:(“cardiac arrest”)) OR (ti.*:(“heart arrest”) OR kw.*:(“Cardiopulmonary resuscitation (CPR); Outcome; Out-of-hospital”) OR kw.*:(“cardiopulmonary resuscitation”) OR kw.*:(“cardiopulmonary resuscitation training”))) AND ((ti.*:(telephone) OR kw.*:(“TELEMEDECINE”)) OR (kw.*:(“PHONE”) OR kw.*:(“TELEPHONE”) OR ti.*:(dispatch*) OR kw.*:(“Hotline”) OR kw.*:(“COMMUNICATION”) OR ti.*:(phone)))

Current content

Key words : phone, telephone, telecommunication, hotline, “cardiopulmonary resuscitation”, “out of hospital cardiac arrest”, “heart arrest”, OHCA, “phone-CPR”

Equation :

((TI=(phone* OR telephone* OR hotline* OR telecommunication* OR dispatch* OR delay) OR TS=(phone* OR telephone* OR hotline* OR telecommunication* OR dispatch*)) AND (TI=(“out of hospital cardiac arrest”) OR (“heart arrest”) OR (“cardiopulmonary resuscitation”) OR (“CPR”)) OR TS=(“out of hospital cardiac arrest”) OR (OHCA) OR (“heart arrest”) OR (“cardiopulmonary resuscitation”) OR (“CPR”))) NOT ((TS=(pediatric* OR pregnant OR child* OR porcine* OR angiogra* OR contracept*)) OR (TI=(pediatric* OR pregnant OR child* OR porcine* OR angiogra* OR contracept*)))

Open sigle

Key words : “out of hospital cardiac arrest”, “arrêt cardiaque extra*”

Equation : discipline:(06*) “arrêt cardiaque extra*” and discipline:(06*) “out-of-hospital cardiac arrest”

- PART II -

**Protocol of an Ancillary study to the DISPATCH trial and
Preliminary results**

INTRODUCTION

In Europe, approximately 275,000 cardiac arrests (CA) (1,2) occur each year outside hospital (85% of total CA) with an estimated survival rate of between 3% and 10% (2). The prognosis is extremely grim and the elements most influencing the prognosis are cardiopulmonary resuscitation (CPR) and the use of an automatic external defibrillator (AED) as early as possible (3).

The 2015 recommendations of the International Liaison Committee On Resuscitation (ILCOR) organize pre-hospital management of out-of-hospital cardiac arrest (OHCA) around the optimization of the chain of survival described by Utstein's model (4,5).

The No-No-Go scheme has been introduced since 2015 into the dispatch protocols (6): the dispatchers are trained to ask the witness whether the victim is conscious, whether he or she is breathing normally. If the answer to both questions is "no", the dispatcher should immediately initiate an emergency medical assistance team and give instruction to the witness in order to initiate telecommunicator-CPR. This protocol provided an improvement in the recognition rate of OHCA (7,8). The time to recognition of a CA is a major prognostic element since it has been shown that there is a 7 to 10% loss of survival rate for each minute elapsed without CPR (9).

CPR is performed spontaneously by witnesses in only 20 to 40% of cases depending on the country (10–12). Dispatcher telephone assistance (DA-CPR) for initiation and instructions of CPR to the bystander is a method that has shown a positive impact on the number of CPR performed (7,13,14) as well as on mortality (7,12,15), and has been validated by numerous studies since 1984 (16).

The DISPATCH stepped wedge implementation trial (NCT03633370) aims to evaluate the effect of a multifaceted intervention on DA-CPR performances. The intervention includes 3

elements: interactive training for dispatchers, motivational feedback of CPR process, and OHCA geolocalisation by a phone application.

This ancillary study of the DISPATCH trial aims to evaluate the specific impact of interactive telecommunication training program on the time to CA recognition. This intervention consists in an online interactive training program to improve cardiac arrest recognition and promote the No-No-Go Protocol. Every dispatcher of the participating centers must follow the training program according to the randomization period of the study.

The objective of this preliminary study is to use a sample of audio tapes included in the study to validate a double-blind listening audio recording protocol by reviewers as a reliable method to report times factors for CA recognition.

MATERIAL AND METHOD

Background

In metropolitan France, where the study is being conducted, distress calls are regulated by “SAMU Centre-15” (Service d'Aide Médicale Urgente: Emergency Medical Assistance Service) located throughout the country. The first telephone contact is made by the dispatcher. These professionals have a training that was not nationalized, and consisted of 4 to 6 weeks of theory, followed by 2 months of supervision. The use of protocols and key words allows them to categorize the degree of severity of each call. The organization of the care of OHCA response in France is based on the chain of survival according to the Utstein's model. The DISPATCH trial aims to train the dispatcher to use the No-No-Go recognition pattern and if a cardiac arrest is identified, to send volunteer bystanders close to the scene using a smartphone. After obtaining the administrative information, the dispatcher should ask two questions: “Is the victim conscious” and “Is the victim breathing normally”. If the answer to these two questions is no, the diagnosis of OHCA is made and the dispatcher should immediately initiate a medical unit according to local protocols and assist the witness in performing DA-CPR (Appendix 2).

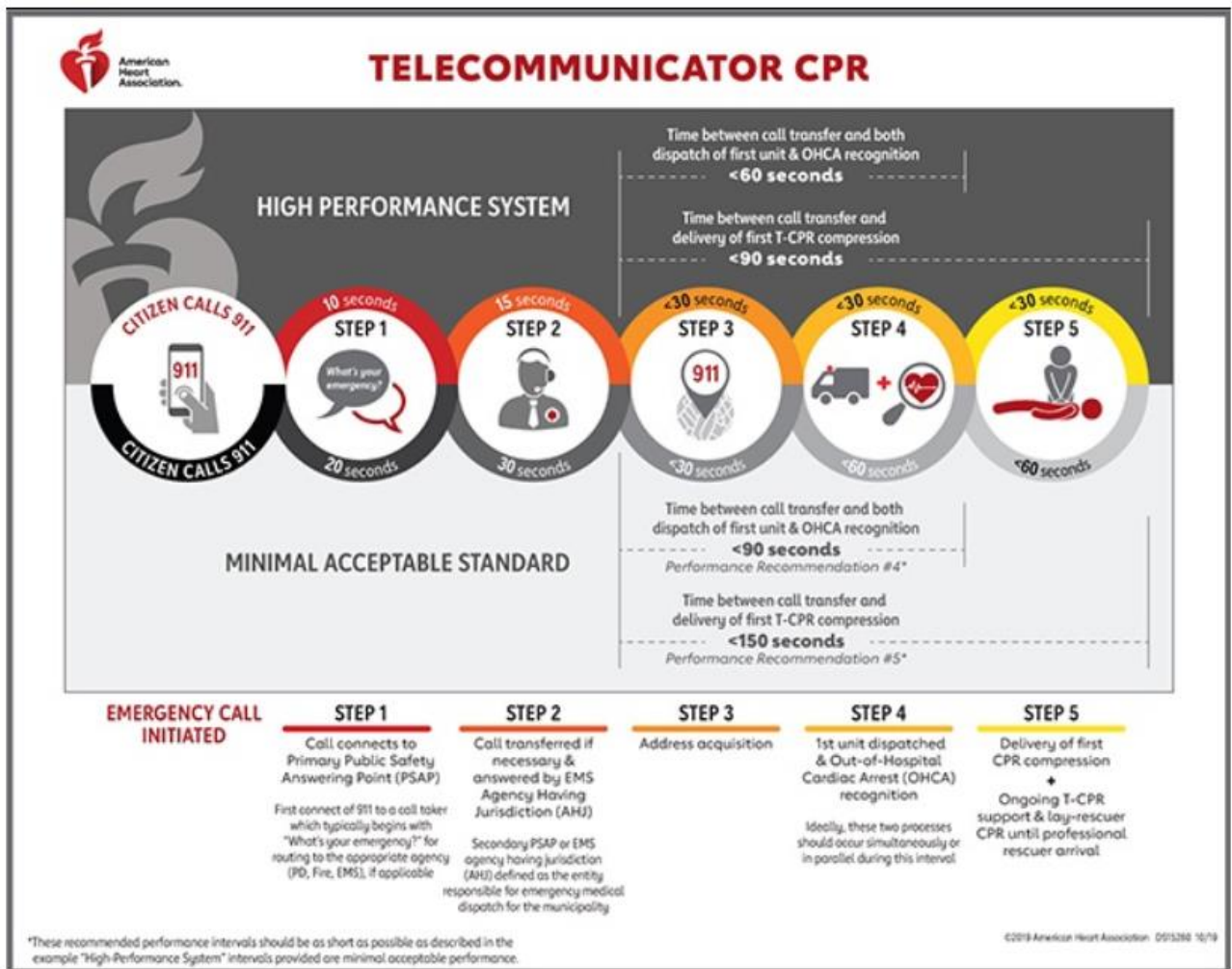


Figure 1. Issued from AHA guideline (17)

Times factors are described in AHA guidelines (17) as time interval standards for emergency calls in dispatch centers. In a high-performance system, OHCA should be recognized within 60 seconds from the reception of the call. Minimal acceptable standards suggest that OHCA should be recognized within 90 seconds from the reception of the call.

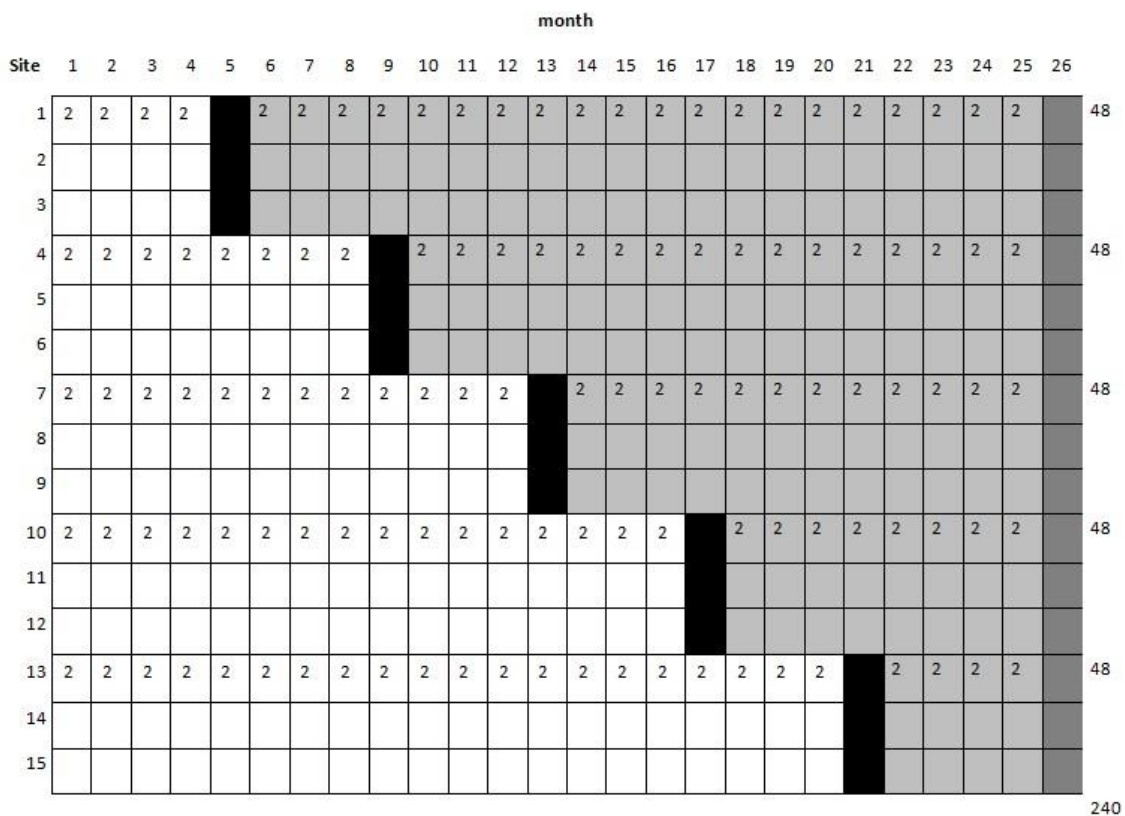
Study design and data collection

The study will be a prospective, multi-center, controlled pre-post training study, ancillary to the DISPATCH study (pragmatic trials of controlled intervention implementation, randomized by center (cluster), in stepped wedge) involving 15 medical emergency call

centers (SAMU-Centre 15) distributed over the French metropolitan territory covering a population of 12,308,757 inhabitants.

We will include all suspected medical OHCA diagnosed on phone call to SAMU-center 15 in adult population. The criteria for non-inclusion will be minor patients, pregnant or breastfeeding women, OHCAs of obvious traumatic origin (including drowning, hanging), OHCAs occurring before a professional rescue team in intervention as well as OHCAs for which resuscitation did not seem justified (unavoidable death, terminal stage of irreversible pathology, duration of cardiac arrest too prolonged, advance directives for non-resuscitation...). One center is randomly selected from the 3 centers in each step of the DISPATCH trial. The number of calls drawn at random is therefore balanced with a 1:1 ratio between the control and intervention phases. In each 5 selected centers, a sample of 2 calls by month will be randomly selected, to include 240 audiotapes.

Figure 2. Complete stepped-wedge design



At the time of switching to the experimental phase, the dispatchers benefit from training built on the concept of active pedagogy, encouraging interactive work by the learner, particularly by listening to recordings of real calls. It is then supplemented by continuous training using a distance learning (DL) including the systematic replay of recorded calls.

The experimental group consists of the regulatory bands of patients included in the experimental phase of the DISPATCH study corresponding to dispatcher-regulated patients with DL training. The control group consists of the control bands of patients included in the DISPATCH study in the control phase either according to usual management of cardiac arrest, without specific training for the dispatcher in the management of cardiac arrest.

For the Ancillary study, the main judgment criterion will be the recognition of CAs in less than 120s, with the hypothesis of an increase in the proportion of CAs recognized in less than 120s to 80% in the interventional phase compared to those regulated in the control phase of the trial. We will analyze the characteristics of the caller and the circumstances of the call. Then we will study the time limits for recognizing the cardiac arrest, the No-No-Go scheme, and the performing of CPR. The time for recognition of cardiac arrest is precisely defined as the time between the dispatcher pick up the phone and the dispatcher's identification of the cardiac arrest. Waiting time between the moment when the call was displayed on the device and the time the phone was picked up is not part of the definition. Identification of CA is determined during listening as the time when the dispatcher verbalizes the diagnosis or CPR instructions ("CPR must be performed", "this is agonal breathing"). The time of the first chest compression is considered when the dispatcher or witness began to count.

Other elements will be analyzed: presence of chest pain or dyspnea preceding the cardiac arrest, presence of convulsions, presence of gasps (and if recognized by the dispatcher), compliance with the No-No-Go scheme. We will also conduct an analysis of the emotional

component of the caller based on the Emotional Content and Cooperation Score (ECCS) scale, validated by The National Academy of Emergency Medical Dispatch (NAEMD) (18,19), which includes a 5-level grading system:

- 1- Normal conversational speech
- 2- Anxious but cooperative
- 3- Moderately upset but cooperative
- 4- Uncooperative, not listening, yelling
- 5- Uncontrollable, hysterical

Clinical informations will be prospectively collected by the medical teams deployed to the site of the OHCAs, and then recorded in a national database "RéaC" (20). Elements include age, gender, location, team arrival times, arrest before witness, presumed etiology of arrest, defibrillation before arrival of SMUR (Service Mobile d'Urgence et de Réanimation : Mobile Emergency and Resuscitation Service), CPR by witness, telephone assisted, SMUR management, initial rhythm, invasive means of ventilation performed, drugs administered, presence of return of spontaneous circulation (ROSC), survival at hospital admission.

Preliminary analysis

A primary analysis was conducted on a sample of 36 audio recording extracted from the Grenoble center's audio recording. The aim of this primary analysis was to validate reliability and reproducibility of double listening of audio recordings by two reviewers.

The two reviewers analyzed the audio recordings according to the ancillary study protocol and reported their measures in a standardized table (Appendix 1).

Interpretation discrepancies greater than a 10 second margin were resolved by a joint replay of the regulation band. If no agreement were found, a third author (GD) listened the audio recording and resolved the discordance. When the interpretation mismatch was less than 10 seconds, an average value between the two plays was used.

Other time factors were issued from SAMU Centre 15 database software (AppliSAMU).

For this preliminary analysis, the reviewers followed the protocol of the ancillary study described above and were blinded from the observational or interventional period of DISPATCH trial and from patients' outcomes. Outcomes and patient characteristics were extracted from RéAC database.

Preliminary analysis assessing the interrater concordance

To describe the reliability of double listening by two reviewers, we use a concordance agreement analysis with Bland Altman analysis.

Preliminary analysis describing a sample population data

Categorical data are presented as counts and percentages, continuous variables as mean \pm standard deviation (SD) or median and interquartile range (IQR). Two-sided P-values less than 0.05 were considered statistically significant.

Further statistical Analysis for ancillary study

After collecting the data, the analysis of the binary qualitative primary criterion (i.e., performance of CPR by a witness prior to the arrival of professional first aid) will be performed in the ITT analysis sample and then repeated in the PP analysis sample. This analysis will be performed using a binary dependent variable logistic regression model. The main judgment criterion is the dependent variable in the model, while the period is introduced into the model as an independent variable. The effect size will be estimated by the *odds ratio*, framed by a 95% confidence interval.

To account for the non-independence of patients within each randomization unit (i.e., cluster), we will use a two-level randomized intercept model (i.e., patients nested in clusters). To overcome the effect of time on the primary outcome (i.e., secular trend, learning, concurrent intervention), a fixed-effect binary indicator covariate will be introduced into the model for each "step" (i.e., the time at which a center moves from the control to the intervention period). To test the robustness of the hypothesis of a homogeneous time effect between clusters, we will develop a similar model with random effect covariates.

The analysis of the secondary judgmental criteria will be an exploratory in purpose only. All analyses will be conducted in the ITT analysis sample and repeated in the PP analysis sample, with a risk of statistical alpha error of 0.05 in the bilateral situation.

Ethics committee and state approval

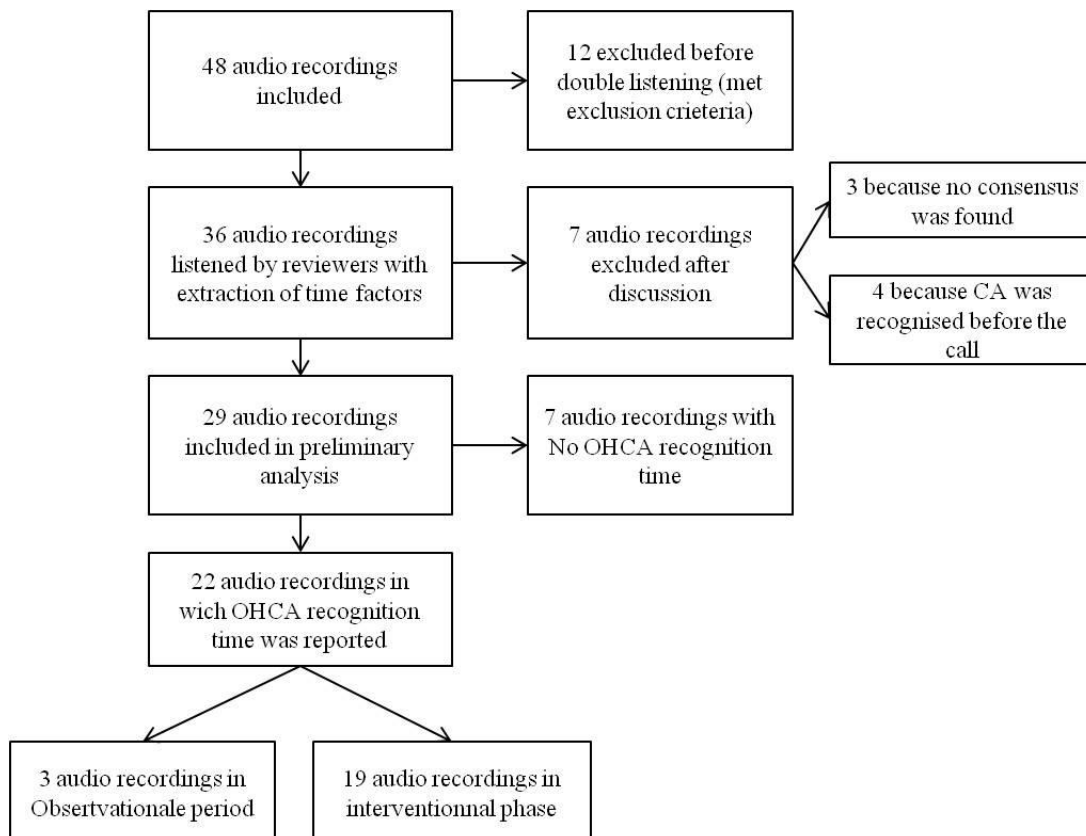
The study is conducted in accordance with the Declaration of Helsinki (modified in Fortaleza in 2013 Cf. full version <http://www.wma.net>), the recommendations of Good Clinical Practice (GCP, ICH E6) and any locally applicable regulations. The data recorded during this research were subject to computerized processing at the CHUGA (University Hospital Center of Grenoble Alpes) in compliance with the law 2018-493 of 20 June 2018 on the protection of personal data. The data processing is carried out in the framework of article 9 of the EU regulation 2016/679. This search has obtained a CNIL authorization. This search is registered on the <http://clinicaltrials.gov/> website (NCT03633370).

RESULTS (Preliminary analysis)

Characteristics of the audio tapes

Forty-eight audio tapes were drawn at random from the audio tapes of the Grenoble SAMU Centre 15 included in DISPATCH. Twelve did not meet the inclusion criteria and were excluded before the double listening, 7 after the double listening following joint listening and discussion. A total of 29 tapes were analyzed, and data extractions were performed. The audio tapes were considered good for all 29 records.

Figure 3. Flow diagram



Cardiac arrests occurred at the patient's home in 87% of cases, and in most cases in men (80%), with an average age of 68 years, and were witnessed in 82% of cases. The witnesses were the family in 72% of cases (Table 1).

The OHCA was recognized in 72% of all cases, and respectively 29% and 86% in the observational and interventional period (p=0.008). CPR in the interventional period was performed spontaneously in 3 cases (14%) and following dispatcher-assisted CPR in 12 cases (57%).

The notion of chest pain prior to the CA was not conclusive to recover and was noted as "unknown" in most cases. The number of people on the phone with the dispatcher was generally 1 except in 5 cases where there were between 2 and 3 people on the phone.

Regarding the caller's anxiety on the phone, the majority had a level of 2 on the ECCS (19) scale and the caller was in all cases with the victim, except in one of the tapes.

Time factors

Table 1. Time factors

Time factors in seconds, median (IQR)		Missing data
Address acquisition (n=28)	80 (50-102)	1
Consciousness assessment (n=18)	43 (19-68)	11
Respiratory assessment (n=24)	56 (20-72)	5
OHCA recognition (n=22)	79 (53-127)	7
RCP instructions (n=18)	133 (89-158)	11
First chest compression (n=15)	185 (151-267)	14
OHCA recognition, n (%)	21 (72)	
OHCA recognition in less than 1 minute, n (%)	9 (31)	1
OHCA recognition in less than 2 minutes, n (%)	15 (51)	1
Consciousness assessment, n (%)	15 (51)	0
Respiratory assessment, n (%)	17 (58)	0
Compliance with NONOGO scheme, n (%)	11 (37)	0
Age (mean)	68	0
Sex (female) , n (%)	6 (20)	0
Witnessed OHCA, n (%)	24 (82)	1
OHCA location, n (%)		1
Residential	25 (87)	
Public	3 (10)	
Medical facilities	1 (3)	
Communication scale, n(%)		
ECCS 1	3 (10)	
ECCS 2	14 (48)	
ECCS 3	7 (24)	
ECCS 4	5 (17)	

We were able to extract the time to recognition of cardiac arrest for 22 of the bands, 3 of which were in the observational phase and 19 in the interventional phase. The CA recognition median time was 79 (IQR: 53-127) seconds for all audio recordings and respectively 162 (IQR: 110-228) seconds for the observational period and 79 (IQR: 44-114) seconds for the interventional period. The median time for the dispatcher to pick up the call was 24 (IQR: 20-35) seconds for this series.

The median time for the dispatcher to pick up the personal information was 80 seconds. The question "Is the patient conscious?" was asked 15 times (51%) by the dispatcher and after a median of 43 seconds. The question "Is the patient breathing?" was asked in 17 (58%) of cases after a median delay of 56 seconds. The No-No-Go scheme was followed in only 11 (37%) of cases (2 (28%) during the observational phase and 11(50%) during the intervention phase, $p=0.4$). When given, CPR instructions began after 126 seconds of communication, and the first chest compressions after 213 seconds. In the 4 cases where CPR did not result in chest compressions, the CA witness was unable to perform CPR despite the dispatcher support.

Reproducibility of listening

The reproducibility of the measurement of the time to recognize cardiac arrest was assessed using the results for OHCA recognition delay recorded by the two reviewers during the audio call listening.

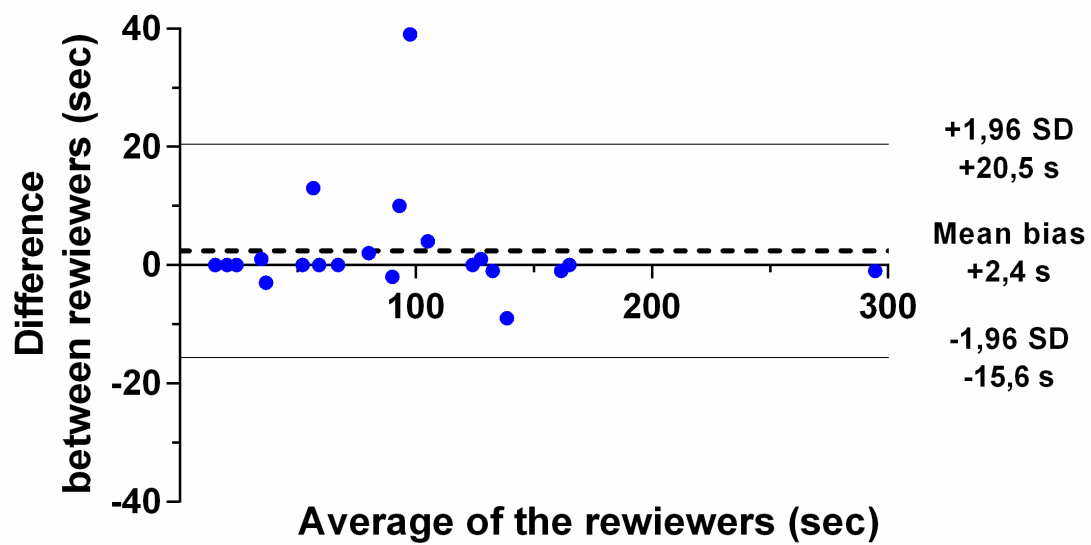
Table 2. Double listening results

	Estimated time to recognition of cardiac arrest during individual listening by reviewers (s)	
	1 st reviewer	2 nd reviewer
1	294	295
2	59	59
3	161	162
4	117	78
5	63	50
6	165	165
7	81	79
8	59	59
9	89	91
10	24	24
11	20	20
12	15	15
13	67	67
14	107	103
15	52	52
16	124	124
17	35	38
18	134	143
19	132	133
20	35	34
21	128	127
22	98	88

Concordance agreement

Bland Altman concordance analysis find a bias of 2.4 seconds between the two reviews and limits of agreement between $-15,6$ seconds and $+20,5$ seconds. For 2 (7%) audio recordings, the difference between the two reviewers was higher than 10 seconds.

Figure 4. Bland-Altman concordance agreement



DISCUSSION

In this preliminary study we were able to observe that a double listening of CA audio recording allowed a reliable identification of time to cardiac arrest recognition. This analysis provides a strong support for the DISPATCH trial ancillary study. The characteristics of the patients, despite a small sample size, are comparable to the data found in the literature: OHCA occurs mainly in men, with an average age between 60 and 70 years, and mostly at home (1,20).

The emotional state of the caller was assessed by reviewers using the ECCS scale. Chien et al. (21) showed that calm callers (ECCS 1) may be a barrier to the recognition of OHCA, and that CPR initiation time is longer for this category of callers. We did not find any difference in the recognition of OHCA or the time to initiate CPR between ECCS 1 and 4-5 callers.

While the OHCA recognition rate was 72% for all bands, it increased to 86% in the intervention period. The AHA recommendations call for a recognition rate of 95%, excluding unrecognizable OHCA (third-party call, hang up, hysteria, CPR in progress, language barriers, other circumstances supervisor deems "unidentifiable"), which were not excluded from our study. This is therefore an encouraging result for the rest of the study, although it must be weighed by the monocentric nature of our preliminary analysis. During the interventional phase, CPR was initiated spontaneously in 14% of cases and following the dispatcher instructions in 57% of cases. The AHA's objectives for performing DA-CPR are 75%, excluding cases where CPR is not feasible (call being made from a different location than the OHCA, caller cannot move patient from bed to floor, caller refuses to perform DA-CPR for safety, other circumstances the supervisor deems valid for why DA-CPR could not be performed), which was not the case in our study. The fact that the majority of callers were elderly women living alone at home could explain such a low rate of DA-CPR performance.

Moreover, the time required for recognition of the OHCA was 79 seconds in the interventional phase. In the literature, time to OHCA recognition ranges from 37 to 211 (22) with a sensibility of 73% (14,23). Such a dispersion is probably due to a heterogeneity of definitions of recognition time, as well as of prehospital care systems depending on the country. In addition, it is highly likely that only centers with a high-performance system will assess the management of OHCAs and publish the results.

Our results are an encouraging element regarding the literature and the main objective and hypothesis of this study.

Due to the small sample size, and the lack of expected significance, we did not conduct quantitative statistical analysis in this preliminary study as provided in the protocol of the ancillary study.

Unfortunately, we found that the NO-NO-GO recognition pattern was in fact rarely respected (only 37% of cases) and would have allowed for the recognition of the OHCA in most unrecognized cases. The elements retained by the 2 reviewers were the absence of clear information concerning the respiratory state, particularly the "normal" character of the latter: the question "Is the patient breathing" was regularly asked, however the NO-NO-GO scheme stipulates that the question must be "Is the patient breathing normally?". Numerous rewordings of the respiratory status were regularly observed, leading to an increase in the recognition delay.

This is a priority area for improvement: the assessment of the respiratory state is one of the main factors delaying the recognition of cardiac arrest (24). Agonal respiration is too frequently associated with the absence of CA and hinders its recognition (25,26) while its presence is a positive prognostic factor on survival and neurological outcome (27) which should motivate early and prolonged CPR.

Concerning the feasibility, we demonstrated that 2 independent reviewer extractions of CA time to recognition after an emergency call is reliable in most cases.

Even if low bias between the two listening was observed in this preliminary study and only 2 cases were associated with a difference of more than 10 seconds, we could not show a satisfying concordance agreement.

One of the case in which the difference between the two reviewers was important regarding the CA recognition delay by the dispatcher was clearly an outlier; and in this case it was not possible to find an agreement between the two reviewers because finding the exact moment when the dispatcher recognized CA was an interpretation from the reviewers.

Even though analysis of OHCA time to recognition by 2 reviewers is generally reliable, there remains a risk of discrepancy. We therefore insist on the need to resolve disagreements by listening together or by analysis by a third expert. Other methods are used, such as in Korea where the regulator presses a "time button" when he recognizes the cardiac arrest and allows instant recording of the recognition time. However, the sensitivity and specificity of such a method remains questionable and reinforces the need for guidelines for the methods of recording time factors in the context of dispatching.

CONCLUSION

This preliminary study shows that the double listening of CA audio recording from Centre 15 dispatch center was reliable in majority of cases. Double listening seems to be necessary because of lack of guidelines regarding the definition of the exact moment of CA recognition by dispatcher, and we recommend to perform a third listening by a third expert when the difference between two first listenings is more than 10 seconds. We validate the audio listening protocol to assess the primary endpoint of this ancillary study. With the limited numbers of audio tapes, we observed the cardiac arrest recognition was 86% and the median time for CA recognition was 79 seconds in interventional period, which is close to the minimal acceptable standards.

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APPENDIX

APPENDIX 1. Audio tapes data extraction


Audio tape	Identity and address (s)	Consciousness evaluation	Consciousness evaluation (s)	Respiration evaluation	Respiration evaluation (s)	OHCA recognition	CA time recognition (s)	CPR instructions (s)	Chest compression (s)	OHCA recognition > 60 s	OHCA recognition < 90 s	No-No-Go scheme followed	ECCS anxiety scale	DISPATCH period	Age	Sex	Witnessed CA	Place of CA
1	48	NO	NA	YES	64	NO	NA	NA	NA	NO	NO	NO	2	O	62	F	YES	Home
2	51	YES	54	NO	59	YES	294	NA	NA	NO	NO	NO	2	O	39	M	YES	Public place
3	91	NO	NA	YES	52	NO	59	NA	NA	NO	NO	NO	1	O	85	M	YES	Home
4	91	NO	32	NO	NA	NO	NA	NA	NA	NO	NO	NO	2	O	62	F	YES	Home
5	19	YES	42	NO	131	NA	NA	NA	NA	NA	NA	NO	3	O	49	M	NO	Home
6	43	YES	46	YES	56	YES	162	245	269	NO	NO	YES	4	O	76	M	YES	Home
7	42	YES	45	YES	45	NO	NA	NA	NA	NO	NO	NO	2	O	27	M	YES	Home
8	105	NO	NA	YES	68	YES	79	149	175	NO	YES	NO	2	I	81	M	NO	Home
9	46	NO	NA	YES	48	YES	58	74	126	YES	YES	YES	4	I	51	M	YES	Home
10	NA	YES	61	YES	79	YES	165	169	NA	NO	NO	NO	4	I	53	M	YES	Home
11	44	NO	NA	YES	10	YES	80	86	123	NO	YES	NO	3	I	56	M	YES	Home
12	141	YES	13	YES	16	YES	59	161	330	YES	YES	YES	2	I	84	M	YES	Home
13	104	NO	NA	NO	NA	YES	90	NA	426	NO	YES	NO	2	I	85	M	YES	Home
14	80	NO	NA	NO	NA	YES	24	30	190	YES	YES	NO	4	I	56	M	YES	Home
15	124	NO	18	NO	13	YES	20	160	267	YES	YES	NO	2	I	80	F	NO	Home
16	46	NO	NA	NO	NA	YES	15	98	268	YES	YES	NO	2	I	77	M	YES	Home
17	53	YES	22	YES	57	YES	67	107	135	NO	YES	YES	2	I	65	M	YES	Home
18	80	YES	9	YES	64	YES	105	173	185	NO	YES	YES	3	I	82	F	NA	NA
19	72	NO	NA	NO	21	YES	52	55	NA	YES	YES	YES	3	I	80	F	YES	Home

Audio tape	Identity and address (s)	Consciousness evaluation	Consciousness evaluation (s)	Respiration evaluation	Respiration evaluation (s)	OHCA recognition	CA time recognition (s)	CPR instructions (s)	Chest compression (s)	OHCA recognition > 60 s	OHCA recognition < 90 s	No-No-Go scheme followed	ECCS anxiety scale	DISPATCH period	Age	Sex	Witnessed CA	Place of CA
20	82	YES	83	NO	115	YES	124	124	124	NO	NO	YES	2	I	65	M	YES	Public place
21	170	YES	70	YES	78	NO	NA	NA	NA	NO	NO	YES	1	I	62	M	YES	Public place
22	106	YES	128	NO	136	NO	NA	NA	NA	NO	NO	NO	4	I	57	M	YES	Home
23	85	YES	88	YES	108	NO	NA	NA	NA	NO	NO	NO	2	I	82	M	YES	Nursing place
24	143	YES	10	YES	17	YES	37	NA	NA	YES	YES	NO	2	I	91	M	YES	Home
25	89	NO	NA	NO	70	YES	134	143	NA	NO	NO	YES	3	I	82	M	NO	Home
26	79	YES	14	YES	16	YES	132	142	167	NO	NO	YES	1	I	66	F	NO	Home
27	60	NO	134	NO	NA	YES	35	75	207	YES	YES	NO	3	I	65	M	YES	Home
28	102	YES	27	YES	18	YES	128	152	NA	NO	NO	YES	3	I	87	M	YES	Home
29	51	NO	NA	YES	21	YES	96	111	174	NO	NO	NO	2	I	73	M	YES	Home
Totaling, n (%)	/	15(52)	/	17 (59)	/	21 (72)	/	/	/	8 (28)	13 (45)	11 (38)	/	/	68*	/	23 (79)	24 (83)**
Median	80	/	43	/	56	/	79	133	185	/	/	/	/	/	/	/	/	/
IQR	(50-102)	/	(19-68)	/	(20-72)	/	(53-127)	(89-158)	(151-267)	/	/	/	/	/	/	/	//	/

*: mean

** : OHCA occurring at home

APPENDIX 2. Dispatch protocol – SAMU Centre 15

	SAMU - SMUR	CRRA-PRO-055
	PRISE EN CHARGE ET RÉGULATION D'UN APPEL POUR SUSPICION D'ARRÊT CARDIAQUE	
Date de diffusion : 15-11-2019 Version : 2 Nombre de pages : 13	Rédigé par : L. Besson, G. Debaty Vérifié par : J. Godart, S. Bernou, G. Binauld Approuvé par : G. Debaty	

I. OBJET

Ce document décrit le schéma optimal de la prise d'appel et de régulation d'un appel pour suspicion d'arrêt cardiaque. La survie des patients ayant fait un arrêt cardiaque est multipliée par 3 si un témoin débute immédiatement un massage cardiaque (registre des arrêts cardiaques RENAÜ 2004-2013). Plusieurs études ont montré une amélioration de la survie suite à la mise en place de conseil téléphonique systématique de réanimation cardio-pulmonaire (RCP) jusqu'à l'arrivée sur place des secours.

II. CHAMP D'APPLICATION

Secteurs

CRRA

Domaine

ARM, Médecins régulateurs

III. DÉFINITIONS

CRRA : Centre de Réception et Régulation des Appels

ARM : Assistant de Régulation Médicale

RENAÜ : Réseau Nord Alpin des Urgences

IV. CORPS DU DOCUMENT

1. Introduction

D'après les données du registre des arrêts cardiaques de l'Isère, la survie à la sortie de l'hôpital d'un patient présentant un arrêt cardiaque pré hospitalier est de 6,6%. Ce faible taux de survie est amélioré par plusieurs facteurs :

- Arrêt cardiaque devant témoin.
- RCP par les témoins.
- Rythme initial choquable.
- Meilleure reconnaissance des arrêts cardiaques à l'appel (notamment respiration agonique).

La présence d'une respiration agonique ou gasp est fréquente au moment de l'arrêt cardiaque (40% des cas) et est associée à un meilleur pronostic. Il est important de la reconnaître pour débiter la RCP.

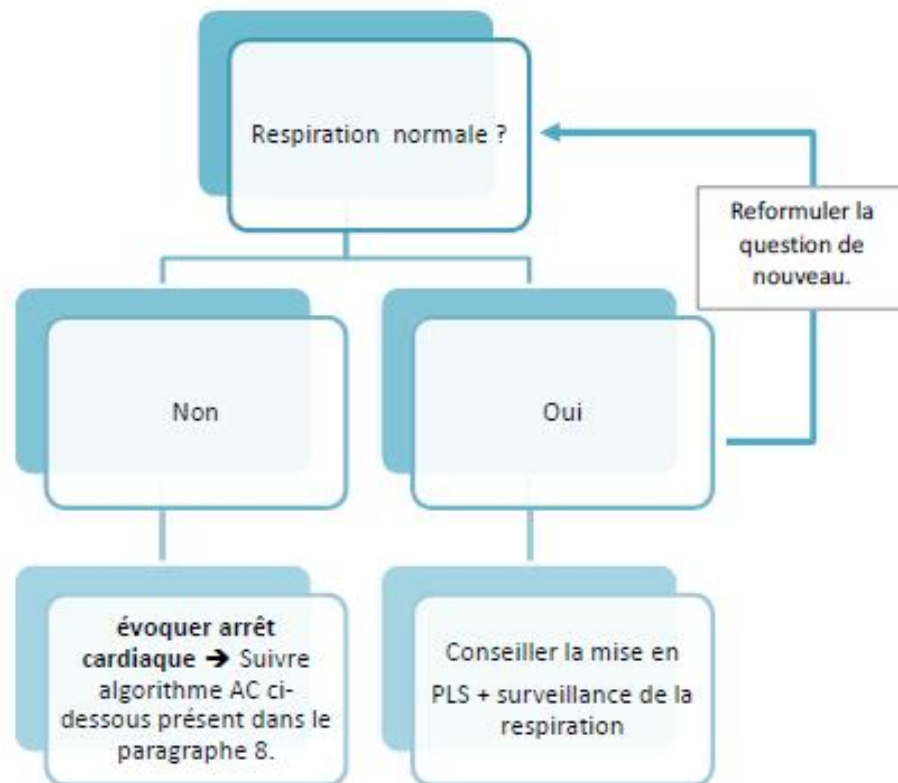
Les procédures d'intervention à appliquer par les sapeurs-pompiers sont décrites dans la procédure RPP – A 507 Arrêt cardio-respiratoire.

2. Objectifs

Améliorer la régulation médicale des patients présentant un arrêt cardiaque pré-hospitalier et faire débiter par téléphone y compris chez quelqu'un de non formé, un massage cardiaque externe et d'accompagner sa réalisation jusqu'à L'ARRIVÉE DES SECOURS SUR PLACE.

3. Informations à recueillir par l'ARM à l'appel

1. Est-ce que la personne répond à un ordre simple : Oui Non
2. A-t-elle une respiration normale ? Oui Non



Un GASP est une respiration agonique. Il s'agit d'une respiration anormale et bruyante (décrite comme des ronflements, gargouillements, des difficultés à respirer, des pauses, une respiration anormale). Ne pas chercher à préciser la respiration ou identifier des gasps, si respiration anormale -> T-RCP. Une seule question doit être posée pour identifier une respiration anormale : est-ce qu'il respire normalement ?

En cas de doute toujours suivre l'algorithme AC et obtenir un avis médical.



La notion de douleur thoracique et de perte de connaissance brutale est très évocatrice d'un arrêt cardiaque : la douleur thoracique évolue vers un arrêt cardiaque durant l'heure qui suit la douleur dans 21% à 33 % des cas.

4. Questions à poser par l'ARM au requérant :

- Présence d'un témoin lors du malaise : Oui Non
- Age de la victime : |_|_|_|_|
- Circonstances de l'arrêt cardiaque ?
 - Médical ou traumatique
 - Évaluation rapide de la durée de no-flow (durée entre l'AC et le début de la RCP)
- Les principaux antécédents médicaux ?
 - Notamment niveau d'autonomie, démence...

5. Les informations qui permettent de ne pas faire commencer la réanimation :

- Tête détachée du corps
- Rigidité cadavérique

6. Éléments devant faire transmettre directement l'appel au médecin régulateur :

- Information donnée par l'entourage de la notion de fin de vie, directives anticipées de non réanimation.
- Patient grabataire, présence de comorbidité (autonomie limitée, démence, pathologie cancéreuse évolutive...)
- Patient en EHPAD.
- Absence de témoin de l'arrêt cardiaque.

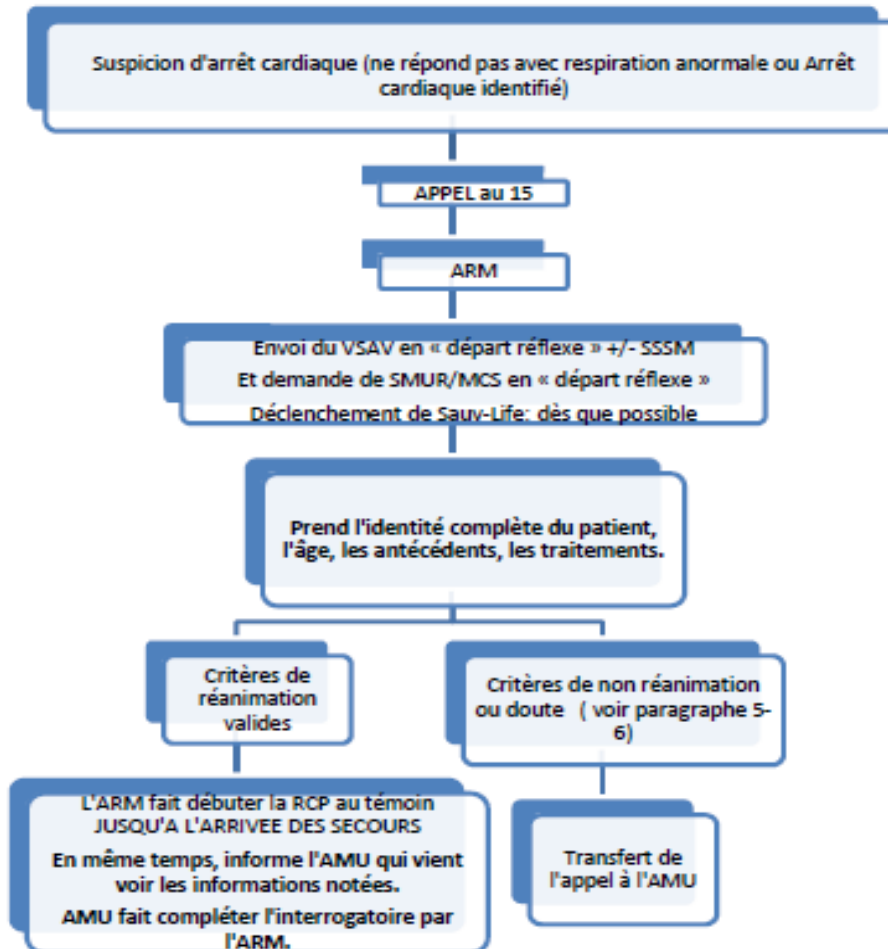
7. Dans quels cas, ne pas déclencher l'application Sauv-Life ?

- ACR suite à pendaison.
- ACR traumatique suite AVP.
- Raideur du corps.
- Plaies par armes à feu.
- Contexte d'agression...
- Toute situation pouvant mettre en danger le sauveteur au ressenti de l'Arm.

8. Cheminement de l'appel

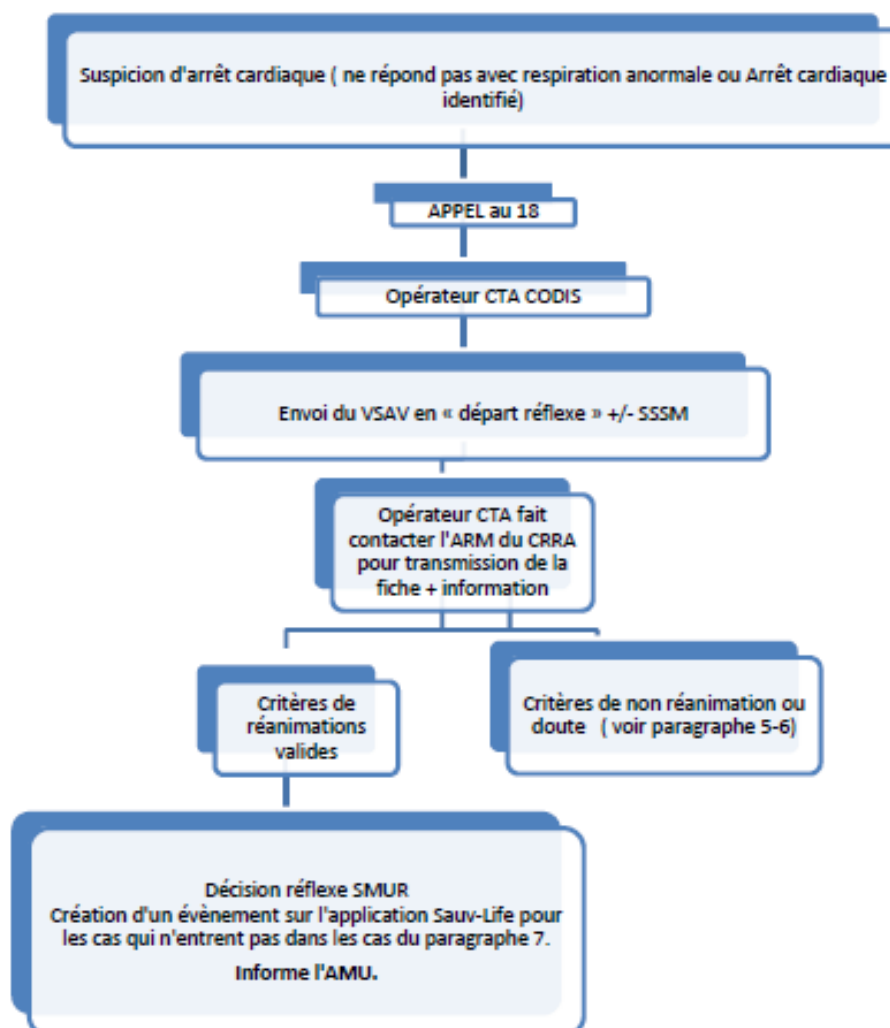
- Appel arrivant au 15

ALGORITHME DE L'APPEL ARRIVANT AU 15 POUR UN ARRÊT CARDIAQUE



- Appel arrivant au 18/112

ALGORITHME DE L'APPEL ARRIVANT AU 18/112 POUR UN ARRÊT CARDIAQUE



• **Fiche conseil RCP :**

- Utilisation systématique d'un métronome en arrière-plan de l'appel, cela permet d'améliorer les conseils de RCP par téléphone, des métronomes sont disponibles en régulation, il est également possible de télécharger des applications de métronome sur les téléphones portables (exemple : Metrotimer, Pro Metronome, Metronome Beats IOS et android). Cela permet au témoin de l'entendre en permanence en fond et de garder le rythme pour pratiquer la RCP.

Adulte - consignes à donner à l'appelant :

1. Mettez votre téléphone en mode haut-parleur.
2. Mettez la personne sur le dos, par terre.
3. Mettez-vous à genoux, sur le côté, le plus près de sa poitrine
4. Placer le talon de la main au centre de la poitrine, entre les deux seins, les bras tendus, la deuxième main au-dessus de la première
5. Maintenant, comprimez la poitrine, enfoncez le plus fort possible la poitrine à ce rythme : et 1, et 2, et 3...
6. Je reste avec vous et je vous aide jusqu'à l'arrivée des secours
7. N'arrêter jamais de faire les compressions
8. Prévenir que des citoyens sauveteurs vont arriver si Sauv-Life a été déclenché
9. Continuez jusqu'à l'arrivée des secours sur place.

Si une seule personne est présente ne pas chercher à faire déplacer et réaliser le massage cardiaque où il se trouve (lit...). Si c'est facilement faisable (plusieurs personnes) faire déplacer sur le sol pour réaliser le massage cardiaque

Enfant - consignes à donner à l'appelant :

1. Mettez votre téléphone en mode haut-parleur.
2. Mettez l'enfant à plat dos au sol.
3. Si vous voyez quelque chose dans la bouche enlevez le
4. Vous allez gonfler ses poumons en faisant du bouche à bouche
5. Recommencez 4 fois
6. Si absence de réaction,
7. Mettez-vous à genoux, sur le côté, le plus près de sa poitrine
8. Placer le talon de la main au centre de la poitrine, entre les deux seins, les bras tendus, la deuxième main au-dessus de la première
9. Maintenant, comprimez la poitrine, enfoncez le plus fort possible la poitrine à ce rythme : et 1, et 2, et 3...
10. Je reste avec vous et je vous aide jusqu'à l'arrivée des secours
11. Réalisez 2 insufflations comme vous avez fait au début.
12. Ne vous arrêtez pas jusqu'à l'arrivée des secours, je reste avec téléphone.
13. Recommencez à comprimer sa poitrine : Et 1, et 2, et 3, et 4, ...,
14. Réalisez 2 insufflations comme vous avez fait au début.
15. Si la personne est seule, demander si l'on peut appeler des voisins pour qu'ils lui viennent en aide. Si oui, le faire faire par un ARM.
16. Continuez jusqu'à l'arrivée des secours sur place.



Message cardiaque 1 main - ERC 2010

VOUS AU



et 30.

voisins
collègue

Nourrisson - consignes à donner à l'appelant ;

1. Mettez votre téléphone en mode haut-parleur.
2. Mettez l'enfant à plat dos au sol.
3. Englobez son nez et sa bouche avec votre bouche et soufflez doucement, en regardant la poitrine se soulever
4. Recommencez 4 fois
5. Si absence de réaction, vous allez procéder à un massage cardiaque.
6. Dénudez le torse du bébé.
7. Positionnez-vous perpendiculairement à l'enfant au niveau de ses épaules, en position à genoux, le plus près possible de sa poitrine
8. Comprimez la poitrine de 3 à 4 cm entre les 2 seins avec 2 doigts (1/3 inférieur du sternum). Vous allez réaliser 30 compressions puis 2 insufflations.
9. Et 1, et 2, et 3, et 4, ..., et 30.
10. Réalisez 2 insufflations comme vous avez fait au début.
11. Ne vous arrêtez pas jusqu'à l'arrivée des secours, je reste avec vous au téléphone.
12. Si la personne est seule, demander si l'on peut appeler des voisins pour qu'ils lui viennent en aide. Si oui, le faire faire par un collègue ARM.
13. Continuez jusqu'à l'arrivée des secours sur place.



Ventilation bouche et nez - ERC 2010



Massage cardiaque 2 doigts - ERC 2010

10. Expressions à employer ou ne pas employer

A. Expressions à employer au téléphone.

- « Vous allez m'aider en attendant les secours. »
- « Le SAMU et les pompiers vont arriver. »

B. Expressions à ne pas employer au téléphone.

- ✗ « Si vous ne le faites pas, il/elle va mourir. »
- ✗ « Vous allez lui sauver la vie. »

11. Connexion à l'application Sauv-Life

Ouvrir le lien suivant :

<https://app.sauv.org/admin/login>

S.A.U.V.

Connexion

Login:	<input type="text" value="samu38"/>
Mot de passe:	<input type="password" value="samu38"/>
<input type="button" value="S'identifier"/>	

12. Ouverture et fermeture d'un évènement Sauv-Life

Se référer à la procédure PDF ou accessible sur l'EAD, dans l'item « SAUV-LIFE En Pratique »
https://elffe.theia.fr/activity/course/eJyrVkrOzytJrShxzMIMLFayUipITUIMz48vTi0uzszPU9KByXu mKfKZmxqYmBrAhcIyU8uBOnJSE4vyUouASvMLSoB6gKZUKxXkJFbGO9UB1aSkpiWW5pQo1dYCANwKJ_A/player/display/270762

IV. RÉFÉRENCES

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V. ANNEXE

PROCÉDURE DE DÉCLENCHEMENT DE L'APPLICATION SAUV-LIFE

Pages suivantes :

CONCLUSION

THÈSE SOUTENUE PAR :

Noémie VIALA
Alexandre LAMANT

TITRE :

IMPORTANCE DU DÉLAI DE RECONNAISSANCE TÉLÉPHONIQUE DE L'ARRÊT CARDIAQUE EXTRA-HOSPITALIER LORS D'UN APPEL À UN CENTRE DE RÉGULATION

CONCLUSION :

L'objectif de notre travail était d'évaluer l'impact du délai de reconnaissance de l'arrêt cardiaque extrahospitalier par le centre de régulation lors d'un appel par un témoin. L'assistant de régulation médicale est à l'initiation de la chaîne de survie. Une reconnaissance rapide de l'arrêt cardiaque est un facteur majeur pour permettre l'initiation immédiate de la réanimation cardio-pulmonaire par le témoin avec assistance téléphonique avant l'arrivée des secours professionnels sur les lieux.

Nous avons, dans une première partie, réalisé une revue systématique de la littérature avec méta-analyse de 13 études rapportant le délai de reconnaissance téléphonique et la survie à court-terme de l'arrêt cardiaque extrahospitalier. Notre méta-régression a objectivé une tendance non-significative à une diminution relative de la survie de 4% (odds ratio, 0,96 ; intervalle de confiance à 95%, 0,91 à 1,00 ; $P = 0,07$) pour chaque augmentation de 10 secondes du délai médian de reconnaissance de l'arrêt cardiaque par l'assistant de régulation médicale.

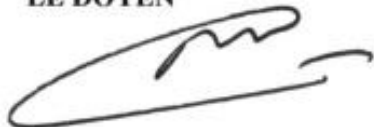
Dans une seconde partie, nous avons réalisé une étude ancillaire de l'étude DISPATCH (NCT03633370) qui consistait à déterminer, dans les centres de régulation du SAMU, l'impact d'une formation à destination des assistants de régulation médicale sur le délai de reconnaissance téléphonique de l'arrêt cardiaque extrahospitalier. Trente-six bandes audio d'un centre sur les cinq centres participant ont pu être analysées. Nous avons montré que la détermination du délai de reconnaissance de l'arrêt cardiaque par deux évaluateurs médicaux indépendants était faisable, avec une reproductibilité satisfaisante.

Les résultats de ce travail suggèrent que le délai de reconnaissance par l'assistant de régulation médicale est un facteur pronostique potentiel associé à la survie de l'arrêt cardiaque extrahospitalier. Ces résultats nécessitent d'être confirmés à l'échelle de l'étude ancillaire de l'essai dispatch avant de recommander des stratégies de formation et de contrôle qualité destinées à améliorer à la fois la proportion et le délai de reconnaissance des arrêts cardiaques extrahospitaliers par les assistants de régulation médicale.

VU ET PERMIS D'IMPRIMER

Grenoble, le : 28 juillet 2020

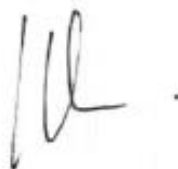
LE DOYEN



Pour le Président
et par délégation

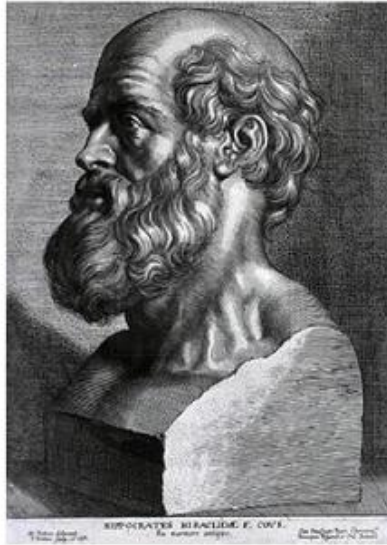
Pr. Patrice MORAND
Pr. Patrice MORAND

LE PRÉSIDENT DE LA THÈSE



Pr. José LABARERE

SERMENT D'HIPPOCRATE



SERMENT D'HIPPOCRATE

En présence des Maîtres de cette Faculté, de mes chers condisciples et devant l'effigie d'HIPPOCRATE,

Je promets et je jure d'être fidèle aux lois de l'honneur et de la probité dans l'exercice de la Médecine.

Je donnerai mes soins gratuitement à l'indigent et n'exigerai jamais un salaire au dessus de mon travail. Je ne participerai à aucun partage clandestin d'honoraires.

Admis dans l'intimité des maisons, mes yeux n'y verront pas ce qui s'y passe ; ma langue taira les secrets qui me seront confiés et mon état ne servira pas à corrompre les mœurs, ni à favoriser le crime.

Je ne permettrai pas que des considérations de religion, de nation, de race, de parti ou de classe sociale viennent s'interposer entre mon devoir et mon patient.

Je garderai le respect absolu de la vie humaine.

Même sous la menace, je n'admettrai pas de faire usage de mes connaissances médicales contre les lois de l'humanité.

Respectueux et reconnaissant envers mes Maîtres, je rendrai à leurs enfants l'instruction que j'ai reçue de leurs pères.

Que les hommes m'accordent leur estime si je suis fidèle à mes promesses.

Que je sois couvert d'opprobre et méprisé de mes confrères si j'y manque.