WFCCN Statement Paper

Raising Awareness of the Benefits of a Standardized (2222) Telephone Number for In-Hospital Cardiac Arrest

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INTRODUCTION

In-hospital cardiac arrest is a reality in every healthcare setting with approximately 90% of all in-hospital cardiac arrests occurring outside of the intensive care unit (Andersen et al., 2019). In the USA approximately 370,000 to 750,000 in hospital resuscitation attempts are made annually (Panesar et al., 2014). The incidence of in-hospital cardiac arrest is approximately 1 to 10 per 1000 hospital admissions with a survival rate ranging from 15% to 30% (Andersen et al.,2019). Survival rate and complete physiological recovery following in-hospital cardiac arrest is less than 20% (Fennessy et al., 2016; Panesar et al., 2014; Schluep et al., 2018). Cardiac arrest is a medical emergency, which can result in permanent brain injury or death if not treated effectively (Bircher et al., 2019; Panesar et al., 2014). A projected 28% of in-hospital cardiac arrest survivors suffer from permanent neurological impairment, which results in decreased quality of life, increased readmission rates, augmented hospital cost as well as a higher mortality risk the year following the cardiac arrest (Chan et al., 2014; Girotra et al., 2015; Harrison et al., 2019), while the 30-day survival rate of in hospital cardiac arrest is approximately 24% (Høybye et al., 2021). A systematic review from 1985 to 2018 indicated that the one-year survival rate following in-hospital cardiac arrest is only 13.4% (Schluep et al., 2018).

RESULTS

Survival rates of cardiac arrest patients increased significantly

when the arrival time of the cardiac arrest team is shorter than 3 minutes (Sandroni et al., 2004). Initiation of CPR within 1 minute, defibrillation within 2 minutes and epinephrine administration within 5 minutes have been linked to improved survival after in-hospital cardiac arrest (Bircher et al., 2019; Donnino et al., 2014). A delay in the treatment following a cardiac arrest is associated with a lower survival rate (Eroglu et al., 2014). However early defibrillation is a key point to enhance the outcome of the patient (Soar et al., 2021). Furthermore, improvement in the survival rate of in-hospital cardiac arrest requires a combined set of coordinated actions referred to as the chain of survival (Deakin, 2018; Eroglu et al., 2014).

The chain of survival aims to demonstrate the interrelationship between key stages of resuscitation and emphasizes the need for all links to be effective in order to enhance the chances of survival. The 2020 American Heart Association Guidelines for CPR and cardiac arrest care clearly re-affirms early onset of CPR and early defibrillation as a key factor in surviving a cardiac arrest (Merchant et al., 2020). The first link in the chain of survival is the emergency team, and the team are usually activated telephonically (Deakin, 2018; Eroglu et al., 2014). It is however vital that hospital staff are trained on how to activate the cardiac arrest team by telephone and training should include the telephone number (Madsen et al., 2021; Soar et al., 2021). Not knowing the correct telephone number is a reason for delayed activation of the cardiac arrest team (Madsen et al., 2021). The delay in activation means delay in treatment of the patient with cardiac arrest and this will lead to poor outcomes or death of the patient with cardiac arrest (Eroglu et al., 2014). A study done on in-hospital cardiac arrest found that the survival of the patient mainly depends on the arrival time of the cardiac arrest team (Madsen et al., 2021). Hence, an efficient system and process to alert the cardiac arrest team is vital.

Previous studies investigating the quality of in-hospital cardiac arrest calls found the duration of the calls ranged between 6 and 92 seconds to activate the cardiac arrest team (Akhtar et al., 2012). Many hospitals use a switchboard operator with no medical background to activate the cardiac arrest team. Many hospitals in many countries throughout the world select an in-patient cardiac arrest call number that is peculiar to their hospital. Recently the Netherlands reported 46 different numbers from 121 hospitals, and Spain had 51 different numbers from 288 different hospitals. A survey in Japan showed 370 different numbers from 756 hospitals having a cardiac arrest system (Whitaker, 2020).

A 2007 study from Australia showed 40 different numbers in 101 surveyed hospitals (Williams & Livingston, 2007) and although some states and private hospital groups in Australia have since developed a standardised number (2222 being the most popular), many do not (Smith, 2019). Even though the European Board of Anaesthesiology as well as the European Society of Anaesthesiology recommended a standardised number (2222) in case of cardiac arrest for use within Europe, only 10% of hospitals have adopted a uniform in-hospital emergency number (Gräsner & Wnent, 2020; Gräsner et al., 2021; European Society of Anaesthesiology and Intensive Care, 2020). Although 76% were using a dedicated number when calling the resuscitation team. 105 different numbers were identified (Trenkler et al., 2017).

The reasons for not standardising the in-hospital cardiac arrest call number are varied. Sometimes the need is not well articulated, yet it is understood that in countries and hospitals with a standardised number have a 96% correct recall compared to 33% in from staff where standardisation has not occurred (Whitaker, 2016). Another concern is the cost of changing signage and the actual number itself. This has been shown to cost from $200 to $5000 per hospital, so it is relatively cheap (https://www.psnetwork.org/ishen2222). More important is the planning and communication to ensure the changeover is seamless and easily accepted by staff (European Society of Anaesthesiology and Intensive Care, 2020). Any concern about safety during the change can easily be removed by continuing to use the existing hospital cardiac arrest number in parallel with 2222 for a period until it is no longer used.

DISCUSSION

The desire to create a single standardised number at the national level was first pursued by the United Kingdom in the early 2000's and confirmed in 2004 with a directive to all NHS hospitals that they would transition to the number 2222 for all in hospital cardiac arrests. Subsequent efforts in other countries have resulted in up to 14 countries formally adopting this standard. Groups such as the World Federation of Societies of Anaesthesiology have endorsed the movement towards 2222 as an initiative that individual countries should adopt to improve patient safety (Barreiro, 2018).The European Resuscitation Council, the European Board of Anaesthesiology and the European Society of Anaesthesiology have issued a joint statement calling upon all European hospitals to use the same internal telephone number (2222) to summon help when one of their patients has a cardiac arrest (Whitaker et al,. 2017).

Better training of administrative staff to recognizing the urgency of the 2222 call and transmitting the correct information is being advocated (Andersen et al., 2019). Notifying the cardiac arrest team one by one could potentially cause a delay of several minutes (Akhtar et al., 2012). The standardization of the number (2222) was supported as only 50% of hospital staff in their study knew the cardiac arrest number. More Physicians in regions with a standardized number knew the number compared to physicians in regions with without standardized number (Lauridsen & Løfgren, 2016). Standardization of the emergency cardiac arrest number is important to ensure early arrival of the cardiac arrest team, and standardization plays a vital role in patient safety (Leotsakos et al., 2014; Soar et al., 2021). The standardization of hospital processes should enable trained healthcare workers to perform effectively in any facility in the world. This supports the importance of standardization of the in-hospital cardiac arrest number of 2222 globally (Leotsakos et al., 2014).

By standardizing best practices in a uniform way in a hospital, across hospitals within a country and ideally within multiple countries will enhance patient safety. Standardising the cardiac arrest telephone number improves staff awareness (Whitaker, 2016). The author indicated that 96% of staff knew the standardised number (2222) in a study done in hospitals where standardised cardiac arrest numbers were utilised. This improves the early activation of the cardiac arrest team which in turn enhances the

patient chances of survival due to early initiation of cardiopulmonary resuscitation. Using the standard cardiac arrest number 2222 is now one of the European Resuscitation Council Guidelines 2021 (Soar et al., 2021).

Implementation of the 2222 number

In terms of change management, the implementation of the 2222 is relatively straight forward as evidenced by many countries having already adopted the standard.

Key considerations include but are not limited to:
o   Establishing a policy that the hospital(s) will implement the number by a particular future date.
o   Ensuring the old cardiac arrest number and the new 2222 can be accessible concurrently during the transition phase so that those who ring the old number out of habit will still get through to raise the alert in a timely manner.
o   Signage on phones, posters, and policies to ensure the messaging of 2222 is consistent and visible throughout the hospital – a marketing campaign to this effect would be ideal.
o   Staff training and drills to reinforce knowledge, awareness and confidence in the new change
o   An evaluation period and process soon after implementation to ensure any minor issues with the change are addressed promptly.

The WFCCN have established a position statement (view Attachment 1) to encourage all hospitals and countries to follow the lead of others who have achieved standardization of 2222. Success with a national standardization process such as 2222 can also be a catalyst to reform more complex practices that would benefit from standardization also.

CONCLUSION
The outcome of patients following in-hospital cardiac arrest is directly related to the speed of activation of the cardiac arrest team. Having a standardized cardiac arrest number of 2222 that all healthcare providers know will ensure rapid activation of the cardiac arrest team. This in turn will ensure early initiation of CPR (1min), defibrillation (3min) and epinephrine (5min) administration to increase the patient survival rate. This standardization of the cardiac arrest number to 2222 would seem to be a patient safety initiative that every hospital should be aware of and consider adopting.

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REFERENCES

Akhtar N, Field RA, Greenwood L, Davies RP, Woolley S, Cooke MW, Perkins GD (2012). Quality of in-hospital cardiac arrest calls: a prospective observational study. *BMJ Quality & Safety* 1:21(3):184-90. doi: 10.1136/bmjqs-2011-000319

Andersen LW, Holmberg MJ, Berg KM, Donnino MW, Granfeldt A (2019). In-hospital cardiac arrest: a review. *Journal of the American Medical Association* 321(12):1200-1210. doi: 10.1001/jama.2019.1696

Barreiro G (2018). International Standardisation of the Cardiac Arrest Hospital Emergency Number Available at: https://www.psnetwork.org/ishen2222/. Accessed on 18 April 2022.

Bircher NG, Chan PS, Xu Y, American Heart Association Get With The Guidelines-Resuscitation Investigators (2019). Delays in cardiopulmonary resuscitation, defibrillation, and epinephrine administration all decrease survival in in-hospital cardiac arrest. *Anesthesiology* 130(3):414-22. doi: 10.1097/ALN.0000000000002563

Chan PS, McNally B, Tang F, Kellermann A (2014). Recent trends in survival from out-of hospital cardiac arrest in the United States. *Circulation* 130(21);1876-1882. doi: 10.1161/CIRCULATIONAHA.114.009711

Deakin CD (2018). The chain of survival: not all links are equal. *Resuscitation* 126:80-82. doi: 10.1016/j.resuscitation.2018.02.012

Donnino MW, Salciccioli JD, Howell MD, Cocchi MN, Giberson B, Berg K, Gautam S, Callaway C, American Heart Association's Get with The Guidelines-Resuscitation Investigators (2014). Time to administration of epinephrine and outcome after in-hospital cardiac arrest with non-shockable rhythms: retrospective analysis of large in-hospital data registry. *British Medical Journal* 20;348:g3028. doi: 10.1136/bmj.g3028

European Society of Anaesthesiology and Intensive Care (2020). 2222 Cardiac Arrest Call Available at: https://www.esaic.org/patient=safety/222-cardiac-arrest-call.

Eroglu SE, Onur O, Urgan O, Denizbasi A, Akoglu H (2014). Blue code: Is it a real emergency? *World Journal of Emergency Medicine* 5(1):20-23. doi: 10.5847/wjem.j.issn.1920-8642.2014.01.003

Fennessy G, Hilton A, Radford S, Bellomo R, Jones D (2016). The epidemiology of in-hospital cardiac arrests in Australia and New Zealand. *Internal Medicine Journal* 46(10):1172-1181. doi: 10.1111/imj.13039

Girotra S, Chan PS, Bradley SM (2015). Post-resuscitation care following out-of-hospital and in-hospital cardiac arrest. *Heart* 15:101(24);1943-1949. doi: 10.1136/heartjnl-2015-307450

Gräsner, JT, Wnent, J (2020). Always on the "safe side" in the hospital? *Anaesthesist* 69:699–701. https://doi.org/10.1007/s00101-020- 00796-5

Harrison JM, Aiken LH, Sloane DM, Brooks Carthon JM, Merchant RM, Berg RA, McHugh MD, American Heart Association's Get with the Guidelines–Resuscitation Investigators (2019). In hospitals with more nurses who have baccalaureate degrees, better outcomes for patients after cardiac arrest. *Health Affairs* 38(7):1087-94. doi: 10.1377/hlthaff.2018.05064

Høybye M, Stankovic N, Holmberg M, Christensen HC, Granfeldt A, Andersen LW (2021). In-hospital vs. out-of-hospital cardiac arrest: patient characteristics and survival. *Resuscitation* 158:157-165. doi: 10.1016/j.resuscitation.2020.11.016

Lauridsen KG, Løfgren B (2016). A call for 2222 in European hospitals—A reply to letter by Dr. Whitaker. *Resuscitation* 1:107:e19. doi: 10.1016/j.resuscitation.2016.07.245

Leotsakos A, Zheng H, Croteau R, Loeb JM, Sherman H, Hoffman C, Morganstein L, O'leary D, Bruneau C, Lee P, Duguid M (2014). Standardization in patient safety: the WHO High 5s project. *International Journal for Quality in Health Care* 26(2):109-16. doi:10.1093/intqhc/mzu010

Madsen JL, Lauridsen KG, Løfgren B (2021). In-hospital cardiac arrest call procedures and delays of the cardiac arrest team: A nationwide study. *Resuscitatio*n Plus 1:5:100087. doi: 10.1016/j.resplu.2021.100087

Merchant RM, Topjian AA, Panchal AR, Cheng A, Aziz K, Berg KM, Lavonas EJ, Magid DJ, Adult Basic and Advanced Life Support, Pediatric Basic and Advanced Life Support, Neonatal Life Support, Resuscitation Education Science, and Systems of Care Writing Groups (2010). Part 1: executive summary: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation.* 142(16_Suppl_2):S337-S357. doi: 10.1161/CIR.0000000000000918

Panesar SS, Ignatowicz AM, Donaldson LJ (2014). Errors in the management of cardiac arrests: an observational study of patient safety incidents in England. *Resuscitation* 85(12):1759-1763. doi: 10.1016/j.resuscitation.2014.09.027

Sandroni C, Ferro G, Santangelo S, Tortora F, Mistura L, Cavallaro F, Caricato A, Antonelli M (2004). In-hospital cardiac arrest: survival depends mainly on the

effectiveness of the emergency response. *Resuscitation* 62(3):291-297. doi: 10.1016/j.resuscitation.2004.03.020

Schluep M, Gravesteijn BY, Stolker RJ, Endeman H, Hoeks SE (2018). One-year survival after in-hospital cardiac arrest: a systematic review and meta-analysis. *Resuscitation* 132:90-100. doi: 10.1016/j.resuscitation.2018.09.001

Smith C (2019).Standardising emergency numbers: The push for 2222. Medcast. Available at: https://medcast.com.au/blogs/standardising-emergency-numbers-the-push-for-2222.

Soar J, Deakin CD, Nolan JP, Perkins G, Yeung J, Couper K, Hall M, Thorne C, Price S, Lockey A, Wyllie J, Hampshire S (2021). *Adult advanced life support guidelines. Resuscitation Council UK*. https://www. resus. org.

Trenkler S, Simonova J, Grochova M (2017). Implementing the standardised cardiac arrest call telephone number for all European hospitals–2222. *Resuscitation* 1:112:e5. doi: 10.1016/j.resuscitation.2016.12.006

Whitaker DK (2020). Standardisation of the "Cardiac Arrest Call" telephone number 2222 (Chapter 16). In Preckel, Benedikt; Staender, Sven; Arnal, Daniel; Brattebø, Guttorm; Feldman, Jeffrey M.; Ffrench-O'Carroll, Robert; Fuchs-Buder, Thomas; Goldhaber-Fiebert, Sara N.; Haller, Guy; Haugen, Arvid S.; Hendrickx, Jan F.A.; Kalkman, Cor J.; Meybohm, Patrick; Neuhaus, Christopher; Østergaard, Doris; Plunkett, Adrian; Schüler, Hans U.; Smith, Andrew F.; Struys, Michel M.R.F.; Subbe, Christian P.; Wacker, Johannes; Welch, John; Whitaker, David K.; Zacharowski, Kai; Mellin-Olsen, Jannicke. Ten years of the Helsinki Declaration on patient safety in anaesthesiology: An expert opinion on peri-operative safety aspects. *European Journal of Anaesthesiology.* 37(7): 521-610. doi: 10.1097/EJA.0000000000001244

Whitaker DK, Nolan JP, Castrén M, Abela C, Goldik Z (2017). Implementing a standard internal telephone number 2222 for cardiac arrest calls in all hospitals in Europe. *Resuscitation* 115:A14-A15. doi: 10.1016/j.resuscitation.2017.03.025

Williams GF, Livingston PM (2007). The diversity of emergency code telephone numbers in Australian hospitals: the feasibility of an Australian standard emergency code. *Australian Health Review* 31(4):540-5. doi: 10.1071/ah070540