Tech for Good: Using Innovation to Improve Outcomes from Sudden Cardiac Arrest

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Summary

In the U.S. there are approximately 350,000 sudden cardiac arrest (SCA) events each year, with survival hovering around 10 percent. Survival is contingent on rapid response with interventions such as cardiopulmonary resuscitation (CPR) by a lay bystander. Current strategies for CPR instruction of lay bystanders are insufficient to meet need. Using innovative technological platforms for instruction and resource allocation may contribute to improved use of CPR by lay bystanders and, subsequently, better outcomes following SCA.

Take a moment and imagine you are outside at your local park. Picture a young man on his bicycle, when suddenly his heart stops and he collapses; what do you do?

In the U.S. there are approximately 350,000 sudden cardiac arrest (SCA) events each year, and survival is low, just 10 percent.[1–4] An SCA occurs when an individual's

heart stops beating unexpectedly; time-sensitive and complex actions, including provision of cardiopulmonary resuscitation (CPR) by a lay bystander, are required within minutes of an arrest to avoid death. For every minute that goes by without someone performing CPR, the chance of survival decreases by 10 percent.[1] Bystander CPR can double the chance of survival for a victim yet only 3 out of 10 people who have an SCA will receive this life-saving intervention.[1]

As a cardiac arrest researcher and clinician I think about this situation all the time; that young man—he doesn't know it yet—but his wife is pregnant, and their child is either going to grow up with his father or he is not, and that is partly dependent on you and others like you who either step up and perform bystander CPR or who do not.

Improving survival from SCA is a significant public health concern that has been emphasized by both the National Academies of Medicine (formerly the Institute of Medicine) and the American Heart Association (AHA).[5–6]

In the National Academies' 2015 report, Strategies to Improve Cardiac Arrest Survival: A Time to Act, they acknowledged that efforts to improve outcomes from SCA in the U.S. are falling short. They discussed strategies to improve outcomes, one of which focused on improvement of public response with the need for immediate recognition of an SCA event followed by activation of 911 and high-quality bystander CPR and AED use. The report

further stated that “the use of innovation technologies (e.g., mobile and social media strategies…) should be considered” in order to improve response and outcomes.[5]

In addition, the updated 2015 AHA CPR Guidelines stressed the need to empower the lay bystander to save a life during an SCA event, stating, “quick action, proper training, use of technology and coordinated efforts can increase survival from cardiac arrest.”[6] Taken together, these recommendations signal the need for innovative solutions to improve bystander response!

Studies have found that lay bystanders do not perform CPR due in part to either lack of CPR knowledge or lack of self-confidence in their ability to perform it when needed. Nationally, only 32 percent of SCA victims receive bystander CPR.1 Of more concern, rates of bystander CPR are significantly less in low socioeconomic status (SES) communities, even though SCA incidence is two times higher, highlighting glaring disparities in SCA care.[7–10] It will take innovative thinking and disruption of the status quo to foster new ideas that will not only improve SCA outcomes overall, but also decrease disparities in the care received.

And, lucky for us, there are a plethora of innovative ideas available, some of which are being tested and implemented today, and some of which are just ideas waiting to take form.

The first innovation to consider is Virtual Reality (VR), because, well, everyone is doing it, even POTUS![11] VR is a computer-programed 3D environment where users interact with alternate realities on a platform that has "an extraordinary capacity to convey the kinds of feelings of presence and place, which creates a visceral emotion of being immersed in a whole new world."[12–13] A recent meta-analysis found that using VR immersion can significantly change behavior in real-life situations.[14] Training the lay public in an immersive environment that simulates the stress and emotion of real emergencies could substantially impact bystander response rates for the better.

Another area of great potential is Augmented Reality (AR). AR allows the user to interact with and overlay holograms in the real environment. AR "supplements the real world with virtual objects, such that virtual objects appear to coexist in the same space as the real world."[15] One of the really interesting AR devices on the market currently is the Microsoft HoloLens, which combines the power of AR along with Skype and 3D video recording capabilities. There is huge potential for use of such a device in the in-hospital setting for telemedicine use.

Though not a technology per se, crowdsourcing, which utilizes large groups of people for one particular project or purpose, when combined with technologies such as mobile health apps, has the potential to save many lives. One example of an mHealth app using crowdsourcing and

technology well is the Pulse Point SCA crowdsourcing app. The Pulse Point app uses geo-location software to send notifications to potential bystanders who have downloaded the app. The app is integrated with local 911 dispatch centers and when someone experiences an SCA and it is called into the dispatch center, a notification goes out to bystanders in close proximity, decreasing the time to the life-saving interventions of CPR and AED use.16 Other similar mobile applications are being used, as well, and have shown promise in terms of bystander response and SCA outcomes.[17]

Another mobile health app that is harnessing the power of crowdsourcing to improve outcomes from SCA is the MyHeartMap Challenge app.[18] The MyHeartMap app allows the general public to locate AEDs and enter them into the app to create an AED registry to map their locations for use during SCA events.

The power of innovation comes when many different ideas and technologies are combined, such as, for example, the game Pokemon Go. Pokemon Go combines the power of augmented reality, mobile apps and gaming. Using an application such as Pokemon Go, which has increased the outdoor exercise activity of many, to, say, crowdsource AED locations, is, by definition, using #techforgood![19] Pokemon Go recently came out with their own wearable, and Apple Watch has also considered partnering with Pokemon Go, which could potentially increase the number of people outside, catching them all—AEDs, that is![20]

One of the more exciting innovations to improve outcomes from SCA is the use of drone technology for good. The Dronesforgood project is developing an “Ambulance Drone” that will bring an AED to an SCA victim.[21] The drone has built-in audio and visual capabilities, allowing trained personnel to assist bystanders remotely during an SCA event.[22]

Finally, in additional to tech, there is great opportunity to bring CPR trainings to the masses for low to no cost using social media platforms such as Twitter’s Periscope or Facebook Live, decreasing the disparities in those who are trained in CPR and those who are not.

So, remember that young man from earlier? You will be happy to know that his child is now 2 years old, and he does get to grow up with his father, because a bystander was there and stepped up and performed CPR when his heart stopped. Not everyone is as lucky as he was—and luck should play no part in this. That is why we need you, the lay public to step up and perform CPR when needed! By harnessing the power of social innovation we not only can prepare lay bystanders with the skills needed to save a life, but decrease disparities in care, making a significant impact for all.

References

1. D. Mozaffarian et al., “Heart disease and stroke statistics—2015 update: a report from the American Heart

Association" Circulation 131, no. 4 (2015): e29–322, doi: 10.1161/CIR.0000000000000152.

2. Bryan McNally et al., "Out-of-Hospital Cardiac Arrest Surveillance—Cardiac Arrest Registry to Enhance Survival (CARES), United States, October 1, 2005—December 31, 2010," Surveillance Summaries 60, no. SS08 (2011): 1–19.

3. Phani Kantamineni, Vamsi Emani, Ankur Saini, Hardeep Rai, and Abhijit Duggal, "Cardiopulmonary Resuscitation in the Hospitalized Patient: Impact of System-Based Variables on Outcomes in Cardiac Arrest," Am J Med Sci. 348, no. 5 (2014): 377–381, doi: 10.1097/MAJ.0000000000000290.

4. Raina M. Merchant, Robert A. Berg, Lin Yang, Lance B. Becker, Peter W. Groeneveld, and Paul S. Chan, "Hospital Variation in Survival After In-hospital Cardiac Arrest." J Am Heart Assoc. 3 (2014): e000400, doi: 10.1161/JAHA.113.000400.

5. "Strategies to Improve Cardiac Arrest Survival: A Time To Act," Institutes of Medicine (2015), accessed October 16, 2016, http://www.nationalacademies.org/hmd/Reports/2015/Strategies-to-Improve-Cardiac-Arrest-Survival.aspx.

6. Steven L. Kronick et al., "Part 4: Systems of Care and Continuous Quality Improvement," Circulation 132, no. 18, supp. 2 (2015): S397–413.

7. Comilla Sasson, David J. Magid, Paul Chan, Elisabeth D. Root, Bryan F. McNally, Arthur L. Kellermann, and Jason S. Haukoos, "Association of Neighborhood Characteristics with Bystander-Initiated CPR," N Engl J Med. 367, no. 17 (2012): 1607–15, doi: 10.1056/NEJMoa1110700.

8. S.K. Wallace, B.S. Abella, F.S. Shofer, M. Leary, R.W. Neumar, C.C. Mechem, D.F. Gaieski, L.B. Becker, and R.S. Band, "Racial Differences in Prehospital Care of Out-of-Hospital Cardiac Arrest," (presentation, Society of Academic Emergency Medicine Annual Meeting, Chicago, IL, May 2012).

9. Jasenka Demirovic, "Cardiopulmonary Resuscitation Programs Revisited: Results of a Community Study Among Older African Americans," Am J Geriatr Cardiol. 13, no. 4 (2004): 182-187.

10. C. Vaillancourt, A. Lui, V.J. De Maio, G.A. Wells, and I.G. Stiell, "Socioeconomic Status Influences Bystander CPR and Survival Rates for Out-of-Hospital Cardiac Arrest Victims," Resuscitation 79, no. 3 (2008): 417-423, doi: 10.1016/j.resuscitation.2008.07.012.

11. Brian Koerber, "Obama Lost in Virtual Reality Prompts Hilarious Photoshop Battle," Mashable, accessed October 16, 2016, http://mashable.com/2016/08/26/obama-vr-headset-photoshop-battle/#oVeJ5R.fTsq4.

12. Gilson Giraldi, Rodrigo Silva, and Jauvane C. de Oliveira, "Introduction to Virtual Reality," LNCC-National

Laboratory for Scientific Visualization and Virtual Reality Laboratory, accessed October 16, 2016, http://www.lncc.br/~jauvane/papers/RelatorioTecnicoLNCC-0603.pdf.

13. "Where Virtual Reality Takes Us," The New York Times (January 21, 2016), accessed October 16, 2016, http://www.nytimes.com/2016/01/21/opinion/sundance-new-frontiers-virtual-reality.html?_r=1.

14. Nexhmedin Morina, Hiske Ijntema, Katharina Meyerbröker, and Paul M.G. Emmelkamp, "Can Virtual Reality Exposure Therapy Gains be Generalized to Real-Life? A Meta-Analysis of Studies Applying Behavioral Assessments," Behav Res Ther. 74 (2015): 18–24, doi: 10.1016/j.brat.2015.08.010.

15. Egui Zhu, Arash Hadadgar, Italo Masiello, and Nabil Zary, "Augmented Reality in Healthcare Education: An Integrative Review," PeerJ. 2 (2014): e469, doi: 10.7717/peerj.469.

16. Pulse Point, accessed October 16, 2016, http://www.pulsepoint.org/.

17. Ruud W.M. Pijls, Patty J. Nelemans, Braim M. Rahel, and Anton P.M. Gorgels, "A Text Message Alert System for Trained Volunteers Improves Out-of-Hospital Cardiac Arrest Survival," Resuscitation 105 (2016): 182–187, doi: 10.1016/j.resuscitation.2016.06.006.

18. MyHeartMap Challenge, University of Pennsylvania, accessed October 16, 2016, http://www.med.upenn.edu/myheartmap/#.WAO7VmNbrOg.

19. Pokemon Go, accessed October 16, 2016, http://www.pokemongo.com/.

20. Chris Plante, "Pokémon Go is coming to the Apple Watch," The Verge (September 7, 2016), accessed October 16, 2016, http://www.theverge.com/2016/9/7/12836820/pokemon-go-apple-watch-release.

21. Drones for Good, accessed October 16, 2016, http://www.alecmomont.com/projects/dronesforgood/.

22. Ambulance Drone, accessed October 16, 2016, https://www.youtube.com/watch?v=y-rEI4bezWc.

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