out of home cardiac arrests.

research report

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abbreviations

OHCA – Out of Home Cardiac Arrest
CPR – Cardiopulmonary Resuscitation
AED – Automatic External Defibrillator
CVD - Cardiovascular Diseases

executive summary.

This report aims to research regarding cardiovascular emergencies and benchmark existing design products, collect data from surveys, observations, and interviews centring the research, analyse and interpret the results, and identify the design implications, problems, and opportunities as a result of the research in order to design for the research topic. This report is crucial to understanding the reasons of bystander CPR rates and how to improve response time in cardiovascular emergencies to design for saving lives and improving mortality rates, as cardiovascular diseases are the leading cause of deaths globally.

This report targets bystanders/laypersons, who are not trained in CPR, responding to cardiac emergencies in everyday contexts, ranging from home environments to shared public areas. The goal of this report is to research design implications from collected data to understand what areas of this topic can be designed better to assist with faster response time and intervention to cardiac emergencies.

Existing products were benchmarked against a criteria of how well they could fulfil the timeline from identifying a cardiac arrest, to contacting emergency services, to providing the right treatment. A market gap was identified where various products were able to perform one aspect of the timeline well, but failed in others. AED was identified as the product that was able to fulfil most of the timeline compared to the other products. Hence, various AED brands were rated against a criteria of durability, visibility, shelf life, ease of use, and portability.

Anonymous surveys and structured observations were conducted and recorded with consent from participants. The survey was targeted towards the general public; a mix of laypersons and people trained in CPR, to understand reasons behind actions responding to cardiac arrests. Observations were structured, where participants – 1 layperson and 1 CPR trained – were told to act as if someone collapsed next to them. Due to the low data sample for both the survey (n=34) and observations (n=2), the data collected had low generalisability as the results cannot be applied to the whole population.

The survey results showed a reoccurring theme of ***Confidence*** and ***Lack of Knowledge*** affecting the general public's ability and hesitation in helping someone having an OHCA, supporting background research. It is also apparent from the observations that the layperson participant showed more signs of ***emotional distress*** compared to the CPR trained participant, and was also unsure of what ***course of action*** to take after calling ***emergency services***, showing that ***Lack of Knowledge*** and ***Emotional Response*** play a large factor.
It is clear based on the data collection and analysis that an opportunity exists to design for ***faster response time*** to correct treatment. Tackling factors in the general public's response to OHCAs requires moving beyond just engineering technology that can automatically perform CPR for a layperson. Immediately responsive, transparent, and comprehensible design are more transformative in enabling laypersons to assist with individuals having an OHCA.

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section 1

the topic



introduction.

Cardiovascular diseases (CVDs), more commonly known as heart diseases, are the leading cause of death globally. Taking 17.9million lives each year, CVDs are a group of disorders relating to the heart and blood vessels (World Health Organization, 2025). In CVD related deaths, 85% were due to cardiovascular crises; characterised as emergency situations where prompt treatment is essential to reduce mortality (Chang et al., 2017). As CVDs are often undetected and untreated, it often presents itself through cardiovascular crises, where rapid response is crucial; a response time of 6 minutes from emergency dispatchers or 7 minutes from bystander CPR is optimal before permanent damage or death (Huang et al., 2021). However, many people don't know how to respond to or know the symptoms/conditions of someone else having a cardiovascular emergency. In Australia, the provision of bystander CPR knowledge stands low, with less than 60% of Australians adults having received CPR training at least once (Cartledge et al., 2020).

This is a critical area to research and study, as many lives are taken every year, where design intervention can be crucial for survival. Hence, the aim of this project is to explore layperson action towards cardiovascular crises in everyday environments. The report aims to cover and identify reasons behind layperson action through surveys and observations, to reach a clearer understanding and thus better design for areas regarding the research topic.

"exploring general public action towards cardiac arrests in public environments."

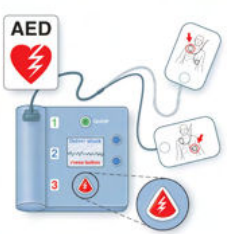
research question

background.

This section aims to discuss cardiovascular emergencies, general public responses, and the design and effect of defibrillators.

Cardiovascular emergencies are usually characterised as a critical situation where the ability of the heart to pump blood is impaired (Nikhil, 2025). It is identifiable by various symptoms, such as varying levels of chest pain, shortness of breath, sudden collapse, and loss of pulse; heart attacks, cardiac arrest, and arrhythmias are the most common forms of cardiovascular emergencies (Banerjee, 2017). Out of home cardiac arrests (OHCA) are one of the leading causes of death amongst CVD related deaths (Liou et al., 2021).

In these situations, after the affected person suddenly collapses and has no pulse, CPR (cardiopulmonary resuscitation) is critical to providing a higher mortality rate until emergency dispatch has arrived. However, as nearly half the population have not had CPR training, they lack the knowledge and confidence to act during critical emergencies. Various factors also contribute to bystanders not wanting to assist in emergencies, such as fear of harming the individual, performing CPR incorrectly, financial and legal repercussions, and feelings of inadequacy (Graham et al., 2015). Even individuals trained in CPR still feel panic and a fear of not performing it correctly (Sasson et al., 2013). In Australia (with the exception of Northern Territory), in contrast to other countries, performing CPR is not legally required, though heavily recommended as emergency dispatchers will guide instructions over the phone to the caller (AED Authority, 2021). Very few people also seem to know about the Good Samaritan law – where an individual is protected if the condition of the affected becomes worse, given they were acting out of good faith – which brews a large amount of fear of harming the individual and thus taking action on OHCA (Hogan, 2023).



(Beckalow, 2026)

Defibrillators are also crucial to increase the chances of survival while waiting for emergency dispatchers to arrive during a cardiovascular emergency. AED (automated external defibrillator) use is also a main factor contributing to the fear of responding to cardiac emergencies, due to the design of the interface. A study conducted by Slabe et al. (2024) compared different types of AED designs to laypersons (general public; individuals with no knowledge of CPR), and found that the design of AED covers, electrodes, and buttons were sources of confusion which inevitably delayed their reaction time of figuring out how to use the device. It also seems apparent that the user interface and diagrams are sources of confusion, also shown by a study done by Mabrouk (2018). Although all AEDs in Australia are registered, allowing emergency dispatchers to guide and alert the caller of the nearest one, there is no federal law requiring the placement of AEDs in public areas, but instead encouraged in high traffic areas (Kieser, 2025).

In summary, this section identified and understood reasons of bystander effect in cardiovascular emergencies, in regard to designing a better way to responding to OHCAs.

benchmarking.

In this section, existing products tending to cardiac emergencies will be discussed and compared to identify an existing market gap and benchmark the starting point of a design.

	Product	Diagnose Condition	Contact Emergency Dispatch	Locate Patient	Self-Operate on Patient	Real-time Patient Data Feedback	Effectiveness on Heart Revival	Provides Bystander Instruction
	Smartwatch	6	10	10	0	6	0	4
	Phone Emergency SOS	8	10	10	-	4	3	7
	AED	8	0	0	8	8	9	9
	CPR Feedback Device	0	0	0	0	7	8	8
	Emergency call buttons	8	10	8	-	4	1	6
	Manual Defibrillators	2	0	0	0	10	9	2

Table 1. Comparison Chart of Employable Devices During an OHCA.

As seen in Table 1, various products can be used to assist during a cardiac emergency. During a cardiac emergency, various capabilities of the device are critical leading to the patient's survival, from a timeline of the ability to identify the condition to effectively producing the right treatment. It is evident that AEDs, CPR feedback devices, and manual defibrillators provide the best real-time patient data (measured in terms of heart rate, blood oxygen levels, duration of arrest, number and depth of chest compressions, time since last shock, etc.), as well effectiveness on heart revival. However, only AEDs are capable of self-operating on patients. Manual defibrillators may excel in real-time feedback and heart revival but are only to be used by trained paramedics and medical professionals, located only in ambulances or hospitals, and ultimately would deem useless if not administered in time (Kieser, 2023). Hence, it also does not provide bystander instructions as the data can only be read by and have shocks manually administered by trained professionals, leaving AEDs to be the only product capable of self-operating on a patient.

It is evident that smartwatches, phone emergency SOS, and emergency call buttons perform better in the first half of the timeline (diagnosis, contacting emergency dispatch, and informing them on location of patient). However, AEDs, CPR feedback devices, and manual defibrillators are better in the second half (self-operating, patient data feedback, heart revival, bystander instructions).

Overall, it is evident that AED fulfils most of the timeline compared to all the other products. This is crucial to understanding that the final design aspires to meet the timeline from beginning to end, as each step is as equally important in ensuring patient survival.

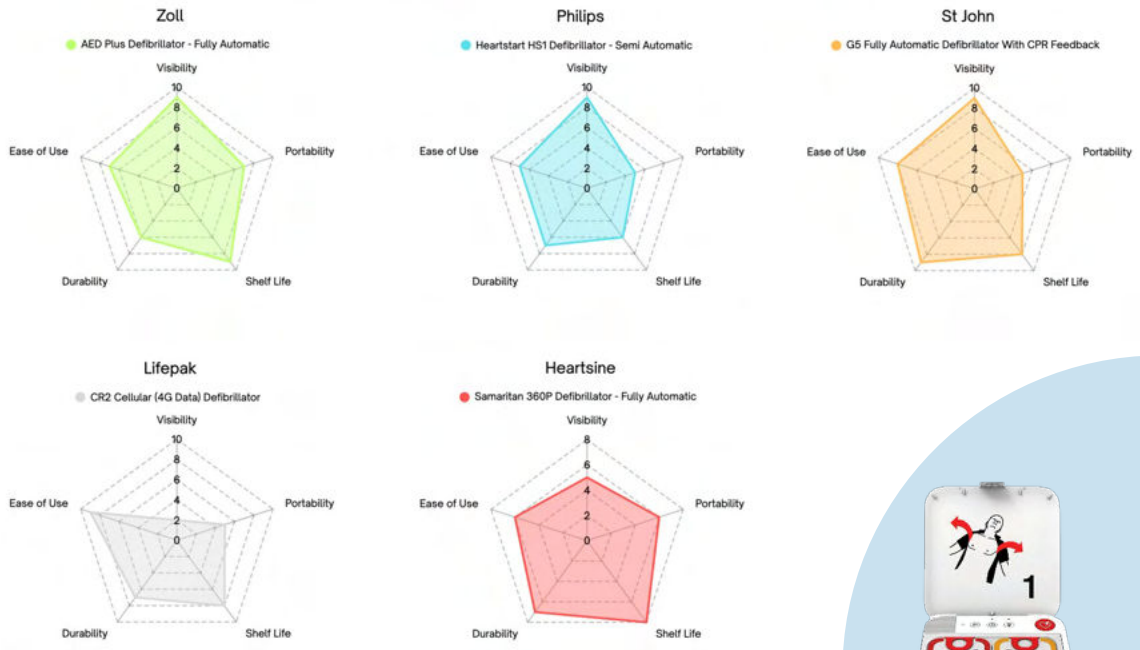


Figure 1. Radar Chart of Various AEDs from Australia's Top AED Companies.



St John

(AED Authority, 2021)

Lifepak

(AED Authority, 2021)



Zoll

(AED Authority, 2021)

As AED was the product that fulfilled most of the timeline, 5 brands from Australia's Top AED companies will be compared against a criteria to identify and analyse the successful design language and features of the most highly rated one (See Appendix).

The most important aspect of an AED is how easy it is for laypersons to use based on first glance, especially during stressful events where time is critical. Convoluted diagrams, too much text, and lack of design signifiers can confuse the user, slowing down the response time to a cardiac emergency. Many AEDs are audio based, giving instructions to the user through voice recorded steps. However, a major flaw of audio instructions is that the user cannot rewind the audio if they cannot hear or have misheard – the AED will repeat the instructions until it detects the user has completed the step, which can cause a long delay waiting for the repeated instructions, or add to the overwhelming atmosphere of the emergency. As seen in Figure 1, the Lifepak Defibrillator had the highest ease of use due to its large visual diagrams that are clear in sight as the device is opened. The portability of an AED is also important, as users of various body abilities are required to carry it to the emergency scene. Visually, an AED should be visible and stand out amongst a public environment, though the cabinet containing it are usually designed specifically for high visibility. Shelf life of an AED is usually 4 years until the electrodes and battery need to be replaced, and some also daily self-checks to prevent failures. Lastly, AEDs must be durable, in case it drops during transportation, be water, dust, shock, and vibration resistant.



Philips

(AED Authority, 2021)



Heartsine

(AED Authority, 2021)

An evident pattern seen from Figure 1 is that portable AEDs are usually not durable; this could be because durability requires more protectant features (stronger, waterproof material, tighter case etc), adding to the weight of the AED. Overall, it is evident St John is the most successful AED with design language that can be learnt from.

In summary, various products were benchmarked and assessed against how well they can be employed during an OHCA, from diagnosis of the condition to providing bystander instructions and reviving the heart. Thereon, a market gap was found wherein products do not meet the full ability of identifying the condition all the way to effectively producing the right treatment for the patient.



section 1 end.

section 2

the research



research.

The focus of this research was to acquire knowledge regarding the general public's knowledge, reaction, and response surrounding cardiac emergencies.

A triangulation approach was used to strengthen the qualitative research data collected and provide a deeper understanding of the research conducted. This methodology is crucial for strong data collection and less method bias; in this case, to deepen the understanding of the general public's knowledge and reaction surrounding cardiac emergencies. Thus, an online survey and two structured observations were chosen to be conducted. These methods were selected as surveys allow for a higher level of control of data, whereas observations precede lower levels of control of data, allowing for a wide range of data control. Surveys were chosen as the most efficient way to gather a small sample of the general population data (regarding their skills and actions towards cardiac emergencies), as well as structured observations to understand the difference between the responses of a layperson compared to a CPR trained individual, as well as real-time emotional responses that the survey is unable measure.

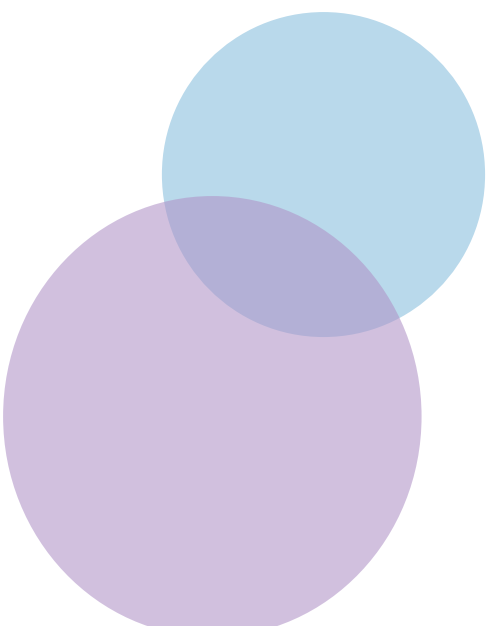
The survey generated 34 responses from the general public, of individuals aged 18-59 years, including university students and people in the workforce. The survey, made in Google Forms, consisted of 26 questions; mostly sentence (short response), and the rest consisted of multiple choice nominal/categorical, interval/ratio, and ordinal questions. These questions allowed for both quantitative and qualitative data to be collected. The survey was structured from general hypothetical questions first to gauge an understanding and general overview of participants' stance, to introducing information about Good Samaritan Laws, AED, and CPR to further understand if it would change their viewpoint.

However, due to the distribution of the survey, a main limitation is the distribution bias, particularly surrounding age range. As the participants were recruited through secondary connections, almost three-quarters (74%) of the participants fell under the age bracket of 18-24 years, causing the survey to not capture the real representation of the general public sample.

Two structured observations were conducted (one with a layperson and one with a CPR trained individual) as it allowed visual insight into their reactions and consequential actions. Both were instructed to reenact and talk through their action towards a hypothetical scenario of someone collapsing next to them at a train station.

However, the main limitation of the observation is the small sample size, as each group (layperson and CPR trained) were only represented by one participant, leading to low generalisability as the participants' actions and reactions cannot be applied to nor represent the whole population. Furthermore, due to the limited secondary connections, the participants representing each group both fell within the age range of 18-24, which again leads to low generalisability as it is not an accurate representation of the whole general population age range. Especially for the CPR trained participant, their personality, prior knowledge, and training of CPR was due to mandatory training in their Health Degree, which may not accurately represent other CPR trained individuals, as everyone has different personalities and stress tolerances to how they respond to situations, and different reasons of learning CPR (family reasons, prerequisite for their profession, medical career etc.).

Overall, the research methods used allowed for a triangulation approach which enhanced the validity and credibility of the qualitative data collected.



analysis & findings.

The results of the survey and observations were decoded and rearranged through thematic coding into a clearer visual format to identify key words and themes.

survey analysis

Univariate content analysis was used to examine the qualitative survey results (sentence response data) through thematic coding, where themes were able to be identified through tracking the frequency of words.

survey findings

Exactly 50% (17 participants) of participants have had prior CPR training before, as seen in Figure 2. When asked to rate their knowledge of heart health related conditions/emergencies from a scale of 1-10 (nothing at all – almost everything), the answers were rather distributed; regardless the mode was 3 and 6, with the average answer being 'somewhat sufficient' (mean=4.6). [chart] Out of 34 respondents, 19 knew one or more people with CVDs (total 35), with all of them aged 51 and above (besides three aged 21, 24, and 43).

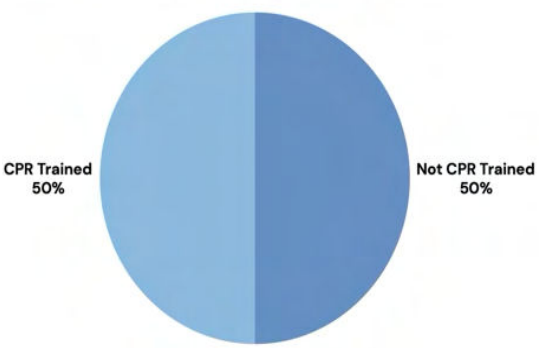


Figure 2. Percentage of CPR trained Survey Participants.

When participants were asked about their first 5 courses of action regarding a hypothetical situation of someone collapsing in a mildly busy (~20 other bystanders) train station, the largest category emerged as ***Checking Conditions***, whether regarding the themes of ***checking the collapsed patient*** or ***environment***, as shown in Figure 3. Participants stated they would check for the patient's breathing (Mode=20), responsiveness, pulse, and consciousness, whereas they would also assess for danger and clear the surrounding area of the patient. The second largest theme related to ***Emergency Services***, with 22 responses revolved around contacting emergency services, and of those responses 5 stated they would continue waiting for emergency services to arrive. Only 17 responses related to actually tending towards a cardiac emergency.



Figure 3. Thematic Coding of Question 10 from Survey Summarised as Sunburst Chart (See Appendix).

Participants were then asked if anything would make them hesitant to help them, to which the largest theme for that question related to ***Self Confidence*** of the participants, with many fearing they would make things worse or felt they were inexperienced and lacked knowledge, as shown in Table 2, quoting "my actions might make things worse" and "I don't know how to do CPR".

Q11: What, if anything, would make you hesitant to help them?

Category	Theme	Sub-code	Count	Quote
Self	Self factors	Infection	1	"Foul smell/infectious"
		Hygiene	3	"if they are dirty" "Hygiene" "If they're a drug addict"
		Time	3	"If I'm late for something" "If I was also in a time crunching situation like going to a corporate interview" "Train coming"
		Stigma	2	"If they were a woman, there's always stigma of looking like a creep (I'm a male) " "If they were a woman (as a man I don't want to get sued)"
		Spectator paralysis	1	"Spectator paralysis"
Confidence	Self confidence	Fear of making things worse	4	"if my actions might make things worse" "accidentally hurting collapsed individual" "scared of doing smth that could danger them"
		Lack of knowledge/inexperience	4	"My inexperience" "Because I don't know how to do CPR" "Lack of knowledge"
		Believing someone is more qualified	2	"If I'm the least qualified person to do something" "If there are others that are more qualified"
		Lack of confidence	3	"Own ability to do CPR" "Confidence" "My non existent real person experience with CPR (have only practised with mannequins"
	Lack of Knowledge	Not sure how to help	2	"Not sure how to help" "Not knowing what their symptoms relate to"

Table 2. Thematic Coding of Question 11 from Survey.

Near the end of the survey, when participants were told about the legality of not needing to performing CPR, 31% of total answers from participants were still regarding fear of performing CPR incorrectly and/or harming the patient, supporting the theme of ***Self Confidence*** (Figure 4). This was followed by 20% of total answers supporting the theme of ***Lack of Knowledge***, as participants were unsure whether CPR would be the right treatment for the patient, and didn't know how to perform CPR.

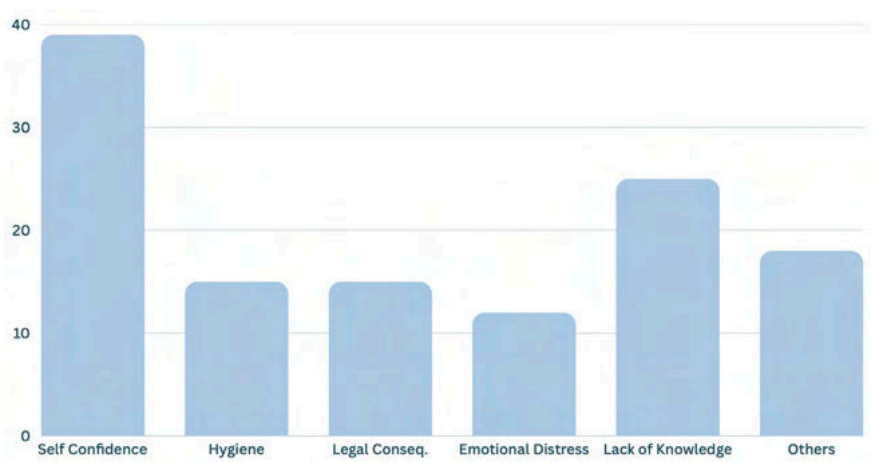


Figure 4. Themes Emerging From Question 22 of Survey (See Appendix).

observation findings

observation analysis

The observations, which focused on actions as well as words, were first manually transcribed and manually coded on Microsoft Word, by applying codes using the comments and highlighter function. Then, the data was applied through conceptual analysis by Affinity Diagramming on Miro, by identifying and sorting individual data points into themes and sub themes.

The observation validated the key theme of ***Checking Patient Condition*** and ***Emergency Services*** from the survey, but ***Deciding Next Form of Action*** and ***Knowledge of Responding*** were themes that emerged which the survey was unable to capture (Figure 5).

Most importantly, the main theme that emerged from the observation that the survey data was unable to capture was the ***Emotional Response*** of the participants. The layperson participant showed more signs of ***emotional distress*** and panic compared to the CPR trained participant. This distress was measured by both participants stuttering over what to say and their body language, especially during the first 20 seconds of witnessing the hypothetical patient collapse. Pointedly, during the call with emergency services, the layperson stuttered more, had to take a deep breath to calm themselves down, and had their hands on their head and chest as a sign of panic (See Appendix). Although the CPR participant also stuttered once on call with Emergency Services, they had also stated, when asked later, "I don't feel panic, I feel concerned".

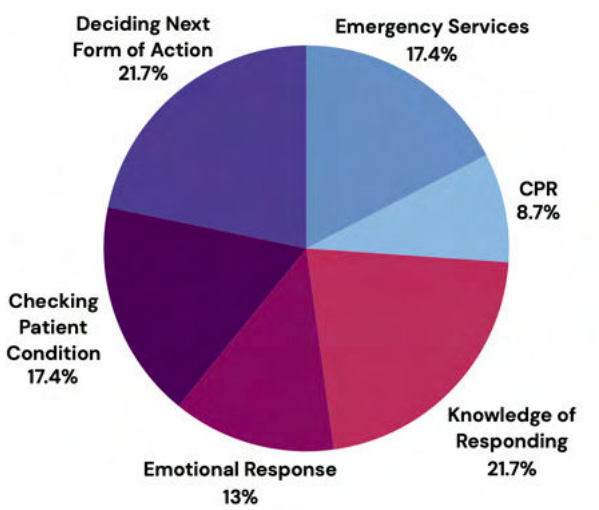
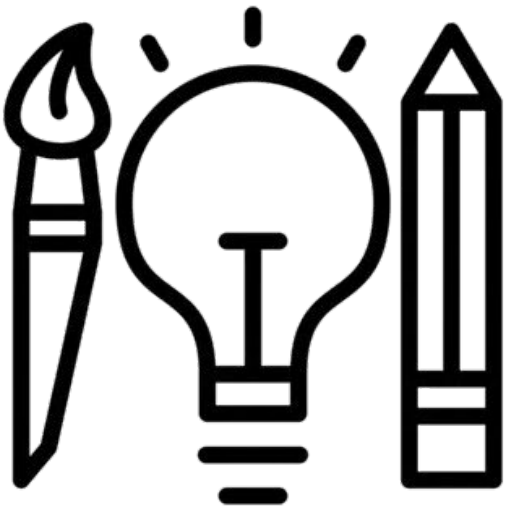


Figure 5. Observation Code Frequency.

The key theme of ***Checking Patient Condition*** was supported largely by the participants' actions of constantly checking back on the patient, even after their call with emergency services (See Appendix). Again, the key category of ***Emergency Services*** was shown in both observations, as both participants stated immediately within the first 10 seconds to call emergency services, then later in the observation stated they would wait for emergency services to arrive in the meantime (See Appendix).

By comparing the open-ended answers from the survey with the behavioural data from the observations through thematic coding, triangulation of the data collection proved to be stronger as the observations allowed insight into how people react in real-time.

Overall, the results of the research had multiple categories and themes emerge, where ***Checking Conditions*** and ***Emergency Services*** were the leading themes in responding to cardiac emergencies. Factors that made the general public hesitant to act were ***Confidence*** and ***Lack of Knowledge***.



section 3

discussion and design implication

discussion.

The data collected supported most of the existing research, yet also provided some insightful information that background research could not provide. For example, statistically, as mentioned in the introduction, less than 60% of Australians know CPR; this information is supported by the survey data collected, where exactly 50% of the participants had prior CPR training.

The survey data surrounding factors in hesitation of commencing CPR and AED use aligned with the background research, with fear of harming the individual, performing CPR incorrectly, and feelings of inadequacy as reasons directing to the category of Confidence, with themes of ***Fear of Harming***, ***Self Confidence***, and ***Lack of Knowledge***.

Furthermore, as response time is crucial in cardiac arrests, bystanders need to act fast and accordingly to the patient. As mentioned in the Introduction, a response time of 7 minutes from bystander CPR is crucial for OHCA survival, and every passing minute without CPR lessens the survival rate by 10% (Hashim et al., 2025). Out of 34 responses, 22 mentioned contacting ***Emergency Services*** as the first 5 courses of action they would take. ***Emergency Services*** are crucial in these situations as they may assist significantly over the phone in helping laypersons to identify the condition of the patient. Of those responses though, the frequency of 42 mentions surrounding the theme of ***Checking Patient Condition*** (referring back to Appendix) may act as a delay in the 7 minutes of response, as checking for pulse, breathing, and responsiveness may vary for different laypersons. Some may feel panic, slowing down their response time; some may feel spectator paralysis or stigma (Table 2).

Surprisingly, fear of legal repercussions for accidental harm differed from the background research, as only 2 mentions of fear of getting sued were mentioned (see Appendix), whereas other sources mentioned it as a leading factor of hesitation to help.

Most importantly, knowledge surrounding the general public being able to identify the signs of a cardiac arrest was data that cannot be found from background research. The survey results bore that (referring back to Figure 3) only 17 out of 34 responses actually mentioned CPR and AED use; only 50% knew how to adequately respond to cardiac arrests fast enough. The rest were hesitant to perform CPR because of their Lack of Knowledge surrounding OHCAs, but mainly because of their ***Self Confidence***; whether CPR is the right course of action, if they might accidentally harm the patient, or believing someone else is more qualified to help.

Moreover, the observation data provided insight into real-time emotional reaction and data towards how bystanders would react and their consequential actions; something that the survey data could not accurately define. The layperson showed more signs of distress – as measured by their stuttering and body language – than the CPR trained participant, most likely due to their ***Lack of Knowledge*** surrounding what to do. The layperson participant also seemed unsure of what to do next after calling ***Emergency Services,*** supporting the theme of ***Lack of Knowledge*** from the survey results. Of course, due to the low generalisability of the observation, this may not be true for everyone, but the CPR trained participant also showed lower signs of distress as mentioned in Section 2.3, and jumped into action immediately after identifying the signs of an OHCA.

design implications.

The findings from this research report were insightful in understanding reasons for slow response time and hesitancy in the general public helping with OHCA.

The main problem identified for laypersons not wanting to assist with someone having an OHCA is mainly due to ***Confidence***. Unsure of the patient's condition, lack of knowledge surrounding CVDs, unsure whether CPR or AED is necessary, fear of performing CPR incorrectly and whether they might harm the individual were all insightful factors. This could provide a pathway for product intervention to attune to these factors, such as helping laypersons to identify the condition of the patient, and the following treatment necessary (whether CPR or AED is needed, etc). Another pathway could be a device that guides or performs CPR for the user, reducing or eliminating fears of performing CPR incorrectly and harming the patient.

Confidence was also the leading category in hesitation to use AEDs because laypersons ***lacked knowledge*** on how to use it, as well as fear of hurting the patient as it may not be the treatment they need. Laypersons seem to lack the knowledge that modern AEDs automatically measure the heartrate and do not shock the patient unless it is necessary. A possible design pathway to combat this could be to get AEDs to the patient faster or redesigning the interface surrounding the AED to help users easily understand it is not a dangerous device.

Another design pathway could be to combat the ***Emotional Response*** of laypersons, helping them calm down faster either through design language or the product itself, as it could significantly improve ***response time*** to OHCAs. ***Emergency Services*** was the second largest category within the scope of the research. As people naturally reach for their phone to call and wait for emergency services, a possible design pathway could be a way to contact emergency services faster or inform laypersons of their location or time of arrival, also assisting in combating their ***Emotional Response***.

As half or more of the Australian population is trained in CPR, a design pathway could be to alert them or get them to assist in nearby OHCAs. Lastly, wearable products for people aged 50+ with higher risks of CVDs could be an insightful design pathway, especially if it alerts bystanders of their condition – this could greatly reduce the ***Emotional Response*** and ***Confidence*** factors surrounding OHCAs, as well as improving ***response time.***

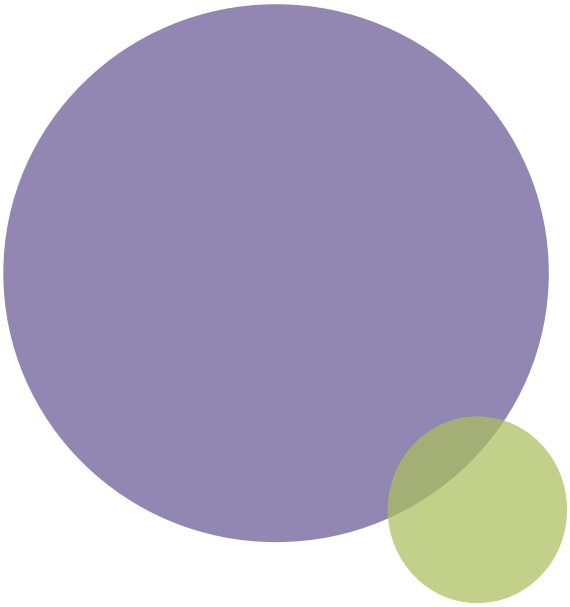
conclusion.

The aim of this report was to explore the key factors of the general public's hesitation in helping someone having an OHCA, and to consider how design opportunities and interventions can arise from the data collected to improve the response time and hence chance of survival of the patient.

Both background and primary research shared key themes surrounding ***Confidence*** and ***Lack of Knowledge*** emerged as the leading factors of hesitation in helping patients with OHCAs and commencing CPR, as well as the use of AED. Addressing these factors through design intervention could be a turning point in changing the response to OHCAs, from faster response time to the correct treatment. ***Emergency Services*** and ***Checking Patient Condition*** were the main themes that emerged as the first courses of action laypersons would take, which proves to be main factors within a design opportunity to reduce response time of tending to OHCAs. ***Emotional Response*** was also another factor that only the observation data unveiled that could also lead to another design intervention, helping in reducing response time.

Ultimately, tackling factors in the general public's response to OHCAs requires moving beyond just engineering technology that can automatically perform CPR for a layperson. Immediately responsive, transparent, and comprehensible design are more transformative in enabling laypersons to assist with individuals having an OHCA.

end.



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