

# Factors influencing the intentions of nurses and respiratory therapists to use automated external defibrillators during in-hospital cardiac arrest: a qualitative interview study

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## ABSTRACT

**Objectives:** Nurses and respiratory therapists are seldom allowed to use automated external defibrillators (AED) during in-hospital cardiac arrest. This can result in significant time delays before defibrillation occurs and lower survival for cardiac arrest victims. We sought to identify barriers and facilitators to AED use by nurses and respiratory therapists.

**Methods:** We conducted semi-structured qualitative interviews with a purposeful sample of nurses and respiratory therapists. We developed the interview guide based on the constructs of the theory of planned behaviour, which elicits salient attitudes, social influences, and control beliefs potentially influencing the intent to use an AED. Interviews were recorded, transcribed verbatim, and analysed until achieving data saturation. Two independent reviewers performed inductive analyses to identify emerging categories and themes, and ranked them by frequency of the number of participants stating the topic.

**Results:** Demographics for the 24 interviewees include mean age 40.5, 79.2% female, 87.5% performed cardiopulmonary resuscitation (CPR), 29.2% defibrillated a patient. Identified attitudes pertained to the timeliness of defibrillation, patient survival, simplicity of AED use, accuracy of rhythm recognition, and harm to self or others. Social influences consisted of physician and hospital administration support of AED use. Control beliefs included training on AED use, policy allowing AED use, familiarity with AED, and task burden during resuscitation.

**Conclusions:** Most nurses and respiratory therapists intended to use an AED if permitted to do so by a medical directive. Successful implementation would require educational initiatives focusing on safety and efficacy of AEDs, support from physicians and hospital administrators, and additional training on AED use.

## RÉSUMÉ

**Objectifs:** Les infirmières et les inhalothérapeutes sont rarement autorisés à utiliser les défibrillateurs externes automatiques (DEA) dans les cas d'arrêt cardiaque survenus en milieu hospitalier. Toutefois, cette lacune peut entraîner des délais importants avant la défibrillation et une diminution du taux de survie chez les malades concernés. Aussi les auteurs de l'étude ont-ils cherché à cerner les obstacles à l'utilisation du DEA par les infirmières et les inhalothérapeutes, de même que les facteurs favorisants.

**Méthode:** Des entrevues qualitatives, semi-structurées ont été menées sur un échantillon d'infirmières et d'inhalothérapeutes choisi à dessein. Le guide des entrevues a été élaboré sur les principes de la théorie du comportement planifié, laquelle tient compte des attitudes de base, des influences sociales et des croyances relatives au contrôle, toutes susceptibles d'influer sur l'intention d'utiliser le DEA. Les entrevues ont été enregistrées, transcrites mot pour mot, puis analysées jusqu'à saturation des données. Deux examinateurs indépendants ont procédé à une analyse inductive afin de cerner les catégories et les thèmes qui se détachaient de l'ensemble, puis les ont classés selon la fréquence des énoncés exprimés par les participants.

**Résultats:** Suivent quelques données démographiques sur les 24 sujets interrogés; l'âge moyen était de 40,5 ans; il y avait 79,2 % de femmes; 87,5 % des sujets avaient déjà effectué des manœuvres de réanimation cardiorespiratoire (RCR) et 29,2 % des participants avaient déjà procédé à une défibrillation. Les attitudes relevées avaient principalement trait à la rapidité d'exécution de la défibrillation, à la survie des patients, à la simplicité d'utilisation du DEA, à la justesse de la reconnaissance du rythme cardiaque et au risque de préjudice à soi-même ou aux autres. Les influences

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sociales consistaient en l'appui des médecins et des administrateurs d'hôpitaux relativement à l'utilisation du DEA. Enfin, les croyances relatives au contrôle comprenaient la formation sur l'utilisation du DEA, les politiques concernant l'autorisation d'utilisation du DEA, une bonne connaissance du DEA et le fardeau des tâches durant les manœuvres de réanimation.

**Conclusions:** La plupart des infirmières et des inhalothérapeutes se montrés favorables à l'utilisation du DEA si une

directive médicale existait à cet effet. La réussite de la mise en œuvre de ce type d'intervention nécessiterait des initiatives en matière d'éducation sur la sécurité d'emploi et l'efficacité du DEA, l'appui des médecins et des administrateurs d'hôpitaux ainsi que des séances supplémentaires de formation sur l'utilisation du DEA.

**Keywords:** allied health personnel, defibrillators, heart arrest, nurses

## INTRODUCTION

In-hospital cardiac arrest is a common event, and overall survival to hospital discharge rarely exceeds 22%.<sup>1,2</sup> A number of in-hospital cardiac arrest patients (18%) have an abnormal electrical heart rhythm that could be fixed with an electrical shock or defibrillation.<sup>3</sup> Cardiac arrest victims are most likely to survive when they are defibrillated within 3 to 5 minutes.<sup>4</sup> Defibrillation is usually provided by a resuscitation team responsible for providing such care in the whole hospital.<sup>5</sup> Unfortunately, our own data suggest this team cannot always arrive at the patient's bedside quickly, leading to an average delay of 9 minutes before defibrillation occurs.<sup>6</sup> Nurses and respiratory therapists are often the first ones at the patient's bedside. They are trained in cardiopulmonary resuscitation (CPR) and can use automated external defibrillators (AED) during out-of-hospital cardiac arrests,<sup>7-10</sup> but are most commonly not allowed to use an AED during in-hospital cardiac arrests. This is true for nurses because AED use is considered a regulated health professional act in most jurisdictions,<sup>11,12</sup> and for respiratory therapists as a common institutional policy. There are limited reports on the attempted use of AEDs by nurses during in-hospital cardiac arrests.<sup>13-15</sup> We need to better understand what would motivate nurses and respiratory therapists to use AEDs if we are to successfully implement such a program.<sup>16,17</sup>

### Theoretical framework

The theory of planned behaviour (TPB) is a conceptual framework very commonly used in health care studies exploring the factors that influence and predict an individual's intention to engage in a behaviour (e.g., using an AED).<sup>18</sup> The likelihood of engaging in a behaviour is determined by the strength of the individual's intentions to carry out the behaviour and their perceived behavioural control over carrying out the action.<sup>18-21</sup> Intention is

determined by measuring the following three predictive variables: attitudes/behavioural beliefs (whether the individual is in favour of doing something), subjective normative beliefs (social pressures), and control beliefs (whether the individual feels in control of engaging in a behaviour). Measuring an individual's intention to engage in a particular behaviour has been shown to correlate well with actually performing the behaviour.<sup>18</sup> Those theoretically derived determinants of behaviour can later be mapped to specific behavioural change techniques.<sup>22</sup> This framework was successful in nursing clinical trials on promoting healthy living,<sup>23</sup> administering opioids for pain relief,<sup>24</sup> and performing venipunctures according to universal precautions.<sup>25</sup>

The purpose of this qualitative study is to identify determinants of behaviour perceived to influence the intention of nurses and respiratory therapists to use an AED during in-hospital cardiac arrest before the arrival of the resuscitation team.

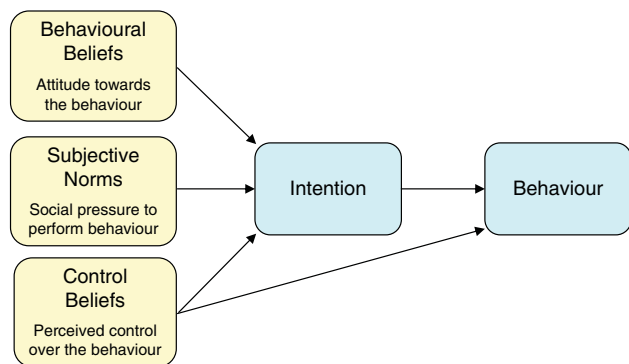
## METHODS

### Study design

We conducted semi-structured qualitative interviews based on the constructs of TPB (Figure 1),<sup>18-21</sup> and developed our interview guide as described by Francis et al.<sup>26</sup>

### Setting

This study was conducted at the Ottawa Hospital – Civic, General, and Riverside campuses. The Civic and General campuses respectively have 456 and 533 inpatient beds, as well as outpatient clinics and day units. The Riverside campus has no inpatient beds, is composed solely of outpatient clinics and day units, and does not have access to a resuscitation team. There is a medical directive in place at the Ottawa Hospital allowing critical care and emergency



**Figure 1.** The theory of planned behaviour.

nurses to use manual defibrillators, and nurses working in locations not accessible to the resuscitation team to use AEDs.

### Study population

We used a purposeful sampling strategy to ensure participation of nurses and respiratory therapists from various departments, with varying levels of experience, and different medical directives in place regarding defibrillation. We approached clinical managers from hospital units of interest to help identify individuals who were interested in participating in the interviews. We recruited nurses from the following units: medicine, surgery, geriatrics, neurology, emergency medicine, intensive care, rehabilitation centre, and outpatient clinics. We recruited respiratory therapists from the following units: operating room, emergency medicine, intensive care, neonatology, and those rotating through various medical/surgical wards. Our institution requires that all nurses and respiratory therapists update their CPR + defibrillation certification yearly. We conducted this study after receiving research ethics approval from the Ottawa Health Science Network Research Ethics Board. Nurses and respiratory therapists voluntarily participated in this study and gave written informed consent. Interviews were conducted outside of working hours, and participants were compensated \$50 CDN for their time.

### Methods of measurement

All interviews were conducted in person (except for one interview conducted by telephone). They were conducted by a single interviewer (JA) using a semi-structured open-ended interview guide based on the

#### Attitudes/Behavioural Beliefs

- What do you believe are the advantages of having nurses/respiratory therapists use AEDs during in-hospital cardiac arrests?
- What do you believe are the disadvantages of having nurses/respiratory therapists use AEDs during in-hospital cardiac arrests?
- What else do you associate with having nurses/respiratory therapists use AEDs during in-hospital cardiac arrests?

#### Subjective Normative Beliefs

- Are there any individuals or groups who would encourage nurses/respiratory therapists to use AEDs during in-hospital cardiac arrests?
- Are there any individuals or groups who would disapprove of nurses/respiratory therapists using AEDs during in-hospital cardiac arrests?
- Are there any individuals or groups whose approval is necessary for nurses/respiratory therapists to use AEDs during in-hospital cardiac arrests?

#### Control Beliefs

- What factors or circumstances currently enable or make it difficult or impossible for nurses/respiratory therapists to use AEDs during in-hospital cardiac arrests?
- What factors need to be in place to enable nurses/respiratory therapists to use AEDs during in-hospital cardiac arrests in the future?
- Are there any other issues that come to mind when you think about nurses/respiratory therapists using AEDs during in-hospital cardiac arrests?

**Figure 2.** Examples of interview questions.

TPB standard practices.<sup>26</sup> Examples of questions asked for each TPB construct are presented in Figure 2. With the participant's consent, interviews were recorded and then transcribed verbatim. Transcripts were verified by the interviewer prior to analysis. We recruited and interviewed new participants until data saturation was achieved (meaning until we obtained no new information during the interview process).<sup>27</sup>

### Main data analysis

Two independent researchers (JA and JLJ) performed inductive analyses of the transcripts to identify common themes or codes. The codes were categorized according to the constructs of the TPB and were counted. A given code could be mentioned several times in an interview but would be counted once only. Additionally, a code was counted as present in an interview if either investigator identified it in the transcript. As soon as all of the transcripts were coded, the codes were examined for common meanings and combined by way of consensus. We listed the codes for each TPB construct in order of frequency and, as suggested by Francis et al.,<sup>26</sup> retained those representing more than 75% of all codes counted. For example, if a common code appeared 50 times, a second code 20 times, a third code 5 times, and 25 other codes each appeared once only, we would have retained the three first codes representing 75% of all codes counted. In addition to these descriptive statistics, we present a narrative interpretation of the data with verbatim illustrative quotes from the participants.

## RESULTS

We completed 24 interviews between June and July 2009. The mean age of the participants was 41 years; most of them were female, registered nurses, and full-time employees with 16 years of experience on average (Table 1). All participants stated that they had been involved in cardiac arrest resuscitation; while most provided CPR to a patient in cardiac arrest, only a few were allowed to use a defibrillator.

We reached data saturation by the 24th interview, with minimal new information gathered in the last 4 interviews. This resulted in a total of 20 behavioural beliefs, 17 subjective norms, and 22 control beliefs (Tables 2-4). The codes were listed in order of frequency within each TPB construct, and only the codes representing more than 75% of all codes identified per construct were retained.<sup>26</sup> After this exercise, eight behavioural beliefs, nine subjective norms, and eight control beliefs remained. Tables 2, 3, and 4 contain a number of verbatim quotes from study participants. We present narrative descriptions of the codes/beliefs in the following paragraphs.

### Behavioural beliefs

#### 1. *Using an AED may affect time to defibrillation.*

Almost all participants acknowledged that time is important when it comes to defibrillation, and 16 participants thought that having nurses and respiratory therapists use AEDs would decrease the time to first shock. In contrast, five participants were unsure as to whether being able to use the AED would decrease the time to first shock because they felt the resuscitation team arrives very quickly. One individual believed that being able to use the AED would not decrease the time to first shock because the patient arrives with the resuscitation team.

#### 2. *Using an AED may affect patient survival.*

Most participants believed that a patient would be more likely to survive if he or she could use an AED, and that survival was often associated with a shorter time to shock delivery. One respiratory therapist felt that patient survival could decrease if an AED were used because it would require changing their focus away from airway management.

#### 3. *An AED is a simple machine and is used in the community.*

A large proportion of participants felt that AEDs are simple machines to use and that a variety of

**Table 1. Characteristics of the 24 interview participants**

Characteristic	Value
Mean age (years, SD)	40.5 ± 10.8
Range	24-61
Female (n, %)	19 (79.2)
Highest qualification	
Bachelor's degree (RN)	6
College diploma (RN)	12
College diploma (RPN)	1
College diploma (RT)	5
Mean years of experience (years, SD)	15.9 ± 9.9
Range	1.5-36
Hospital department	
Nurses	
Medicine	5
Surgery	5
ICU/CCU	2
Emergency	1
Neurology observation area	1
In-hospital outpatient clinics	1
Outpatient clinics and inpatient units Isolated from the main hospital	4
Respiratory therapists	
Wards, emergency, neonatology, ICU/CCU	4
Operating room	1
Employment status	
Full time	16
Part time	6
Other	1
Highest resuscitation certification	
CPR + AED use	17
Advanced cardiac life support	7
Resuscitation experience (at least once)	
Involved in cardiac arrest resuscitation	24
Performed CPR	21
Defibrillated a patient (AED or manually)	7
Current medical directive applying to participant	
Not allowed to defibrillate	17
Able to defibrillate with AED	4
Able to defibrillate manually	3

AED = automated external defibrillation; CCU = coronary care unit; CPR = cardiopulmonary resuscitation; ICU = intensive care unit; RN = registered nurse; RPN = registered practical nurse; RT = respiratory therapist; SD = standard deviation.

non-medical professionals are currently using them safely.

#### 4. *An AED can/cannot accurately recognize heart rhythm.*

Participants had diverging opinions about whether AEDs accurately recognize cardiac rhythms. Ten individuals were confident that AEDs could correctly identify cardiac rhythm, whereas six others had doubts. In addition, four individuals mentioned

wanting to be able to see the rhythm themselves (which is not shown by AEDs) to determine whether a shock was necessary.

5. ***Using an AED may cause more/less harm to the patient, myself, or others.***

Participants also expressed diverging opinions regarding harm to the patient, themselves, or others when using the AED. Six individuals felt that using an AED could result in less harm done to patients by possibly avoiding the need for CPR and resulting broken ribs. Many understood that using an AED would not harm the patient, themselves, or their coworkers because they are aware of the proper procedure when defibrillating; 13 participants were unsure or concerned that the patient could be harmed by inappropriately receiving a shock, or that they or their coworkers could be harmed by receiving a shock.

6. ***Using an AED may affect the stress experienced during a resuscitation.***

More than half of the participants expressed opinions regarding the stress that would be involved when using the AED. Three participants felt that using the AED could either increase or decrease the stress that they felt, depending on the situation, two participants felt that they would experience less stress, and nine participants felt that they would experience more stress during the cardiac arrest if they had to use an AED.

7. ***First responder defibrillation is important.***

More than half of the participants believed that the first responder to a cardiac arrest event should be allowed to use the AED. They expressed that first responder defibrillation is an important part of the initial resuscitation attempt prior to resuscitation team arrival.

8. ***Using the AED is the best thing for the patient.***

Eleven participants expressed that using an AED is the best treatment for the patient. Participants acknowledged the role of CPR and medications in the resuscitation effort but felt that using an AED would be the best management option.

### ***Subjective norms***

According to interviewees, subjective norms had little influence on the decision to use an AED compared to behavioural and control beliefs.

1. ***Individual group peer-pressure***

Of the nine subjective norms most commonly identified by the participants, eight represented individuals or groups that would have some influence on the participant's intention to use the AED. They are in order of decreasing frequency: physicians, hospital administration, other health care professionals, colleagues, College of Nurses of Ontario/College of Respiratory Therapists of Ontario, patients, the public, and managers. For example, the approval/expectation of physicians responding to a cardiac arrest was perceived to be of some importance.

2. ***Collective peer-pressure***

One subjective norm, identified by 11 of the participants, was not a specific individual or group but rather was described as the culture or common acceptance within the hospital supporting AED use.

### ***Control beliefs***

1. ***Training on AED***

All interviewees expressed the opinion that having the appropriate training is a facilitator to using AEDs. Only three individuals felt that their current training was sufficient for them to use an AED; among these three, two were allowed to use an AED in the hospital setting. Nine individuals mentioned having received training to use an AED but felt they would benefit from additional or more frequent training.

2. ***Policy allowing AED use***

The vast majority of participants stated that a hospital policy outlining the use of AEDs by nurses and respiratory therapists would facilitate their using an AED. Eight individuals felt that it would be necessary to have the support and/or approval of their regulatory college before they could use an AED during in-hospital cardiac arrests. Some participants were concerned that legal actions could result from their use of an AED, unless a hospital policy was in place.

3. ***Familiarity with AED***

Most participants expressed the importance of being familiar with the AED prior to using it. Familiarity with the AED could be achieved by being responsible for its regular maintenance and scheduled verification of proper function.



Table 2. Behavioural beliefs		
Code	Frequency	Example quotes
Using an AED may affect time to defibrillation.	22	<i>The advantage of an AED is that it can be applied as somebody is doing CPR and that they can take their hands off the patient; it can analyse the rhythm and it can actually defibrillate the patient and get it done faster, even before the code team arrives.</i>
		<i>I'll be honest with you. The code response, like the team arrives really quickly. So, between the time that we find the patient, the time it would take us to hook up the monitor, the team would arrive. But I think it would be a good thing, just in case, you know, we're on our own and they're stuck doing something else, I don't know. I honestly think that we may not have enough time to use the AED 'cause it goes so fast.</i>
Using an AED may affect patient survival.	22	<i>If we have an AED, we could have it put on the patient and it could tell us what kind of rhythm it is and mind you if it is a rhythm that needs defibrillation, obviously the patient would be defibrillated and what I find is that we could be more of use in the sense in helping to increase the chances of resuscitating this patient.</i>
AED is a simple machine and is used in the community.	20	<i>The AEDs are very simple to use, just apply and press on and follow the instructions.</i>
		<i>Personally I don't understand why we can't use the AEDs. You've got the people in the community, anybody can use them. They're in the arena, they're in the swimming pool areas, malls, anyone can use them. And here we're all trained professionals and we're not even allowed to use them.</i>
AED can/cannot accurately recognize heart rhythms.	20	<i>I trust that it can actually interpret the rhythm and determine whether or not it's a shockable rhythm or not. I don't distrust the machine being able to do that.</i>
		<i>Well, hopefully it reads the right rhythm. Apparently they don't make mistakes, I don't know.</i>
		<i>Well I think you should just, I don't think we should ever just rely on technology to tell us what to do. I think you need to have a little bit of background in rhythm recognition to know what's happening with your patient before you just start randomly pushing buttons, shocking them out of nowhere.</i>
Using an AED may cause more/less harm to patient, self, or others.	19	<i>Would it hurt them in any way or . . . I don't think it will because their dead, but anything we do is better than nothing.</i>
		<i>People, bystanders, not bystanders but the rest of the team being shocked as well if they're still around the bed and shocking and not calling "all clear."</i>
		<i>Well, like what we're talking about the lack of proper reading, so suppose it's...if someone's moving the bed or, um, you have to, you end up doing the wrong thing...and then you can end up hurting them as opposed to helping them. . . I think that would be bad. . . Harming. Shocking in a case that wouldn't need it.</i>
Using an AED may affect the stress felt during a resuscitation.	14	<i>It doesn't give me any greater sense of panic to be "oh, wow another step in the process" because I think the step of utilizing them might sort of alleviate the stress of, you know waiting like few minutes that it might take for the code team to arrive knowing that you know you've got this on the chest and you know its adding another intervention into possibly helping the patient's outcome in the end.</i>
		<i>I'd be pretty shaky afterwards, I really would. It's an adrenaline rush as it is for us at the bedside; it's not as much as an adrenaline rush for the ones that are doing it everyday. For us that are not involved in something critical like that everyday is hard on our mental health and our stress level.</i>
First responder defibrillation is important.	11	<i>I think that the first person that shows up should be able to do it. We are trained to read rhythms, even though anyone who uses an AED doesn't need to read a rhythm. I think that any professional should be able to activate an AED.</i>

**Table 2. (Continued)**

Code	Frequency	Example quotes
Using the AED is the best thing for the patient.	11*	<i>My supporting arguments for that is we're both on the units and the patient is there and whoever finds the patient first would start the code blue. Would check for a response, call the code blue, get things rolling . . . So I think that my job as much to do compressions as it is to put on the defibrillator.</i> <i>I guess, just from my training and my previous experience, hands down access to automated external defibrillators is by far the best for the patient. In a public setting, even in public settings in a hospital, the coffee shop, at the information check-in desk, at that kind of thing, it would make a lot of sense.</i>
AEDs should be used only on someone we know is full code status.	5	
Good thing to know how to do and provides independence as a health care provider.	5	
Have the medical background and knowledge to use the AED.	5	
AED provides information for the resuscitation team once they arrive.	4	
AED takes over code by providing clear instructions and organizing the response.	4	
Using AED will mean you have tried to defibrillate and can move on to the next treatment.	4	
Using the AED will mean the loss of critical care skills or critical thinking ability.	3	
Individuals should volunteer to use the AED, and it should be a selected group of individuals who use it.	3	
This group of health care providers covers all of the patient areas and could respond anywhere.	3	
It is easier to maintain training with a smaller group of individuals using the AED.	2	
AED can be misused by the individual.	1	
Patient will feel good knowing the AED can be used.	1	

\* &gt; 75% of all codes reached.

**Table 3. Subjective norms**

Code	Frequency	Example quotes
Physicians support using AEDs.	21	<i>Well, it's just because if nurses, uh, are allowed to use AEDs, we need to have the back up from the doctors also.</i>
Hospital administration supports using AEDs.	19	<i>... then it has to work its way down through the system that each hospital has their own policies and procedures on how they are going to initiate it out through the hospital.</i>
Other health care professionals support using AEDs.	16	<i>Well, I think, we all work together, right, so I think pretty much from the healthcare team would approve of that.</i>
Colleagues support using AEDs.	15	<i>Nurses themselves would have to support each other in the decision to or not to.</i>
College of Nurses or RTs supports using AEDs.	15	<i>Well the College of Nurses would have to make sure there is some sort of, it's within our control acts.</i>  <i>It would have to come from our college. The people that delegate acts ... regulators from our college. There obviously would be higher administrative talks with the proper associations and counsels in order for them to give a proper regulation of our acts and specifically the use of AEDs for respiratory therapists.</i>
Patients support using AEDs.	12	<i>Well I think under the circumstances I think they would be, certainly the patient who is in that situation would probably approve of it, if it means that things can be done more quickly. I don't think the patients would disapprove because again we are using them out in the community in public areas and places.</i>
The public supports using AEDs.	12	<i>I think if the public knew, I think they would support it because I think the public trusts nurses and RTs so I think they would think that that was good.</i>  <i>I think most people would, again, the general public see it in the local pools ,you know, so they kind of think nurses must be able to use it.</i>
Managers support using AEDs.	11	<i>I think they would approve. Yah, um, the nursing managers would certainly approve, I think. But they would want to make sure that their staff is properly trained for that.</i>
Culture within the hospital supports using AEDs.	11*	<i>When we have code blues, if nurses begin to use the AED, we want to make sure that the doctors that are going to come in, the residents, the respiratory therapists are going to say 'Oh, okay so you already did that! Good'. Instead of 'oh, so why didn't you wait for us?'</i>
Patient's family supports using AEDs.	6	
Organizations (e.g., Heart and Stroke Foundation) support using AEDs.	3	
Others unsure of respiratory therapists' abilities support using AEDs.	2	
Resuscitation team supports using AEDs.	2	
Union (e.g., ONA) supports using AEDs.	2	
Paramedics support using AEDs.	2	
City of Ottawa supports using AEDs.	1	
Government supports using AEDs.	1	

\* > 75% of all codes reached.

#### 4. *Role in cardiac arrest resuscitation*

Numerous participants mentioned that defibrillation is the role of physicians, the resuscitation team, or advanced cardiac life support (ACLS) certified health care providers. Participants were concerned that using an AED to defibrillate a patient would mean making decisions that physicians normally make. Of note, 16 of 17 individuals who were not allowed to use an AED/defibrillator expressed this opinion, whereas only 3 of 7 individuals currently allowed to use an AED/defibrillator shared this opinion.

#### 5. *Machine availability and proximity*

A large proportion of participants stated that, for AEDs to be useful, they should be distributed

throughout the hospital in such a way to assure their proximity and rapid access.

#### 6. *Experience with cardiac arrest resuscitation*

Over two thirds of participants stressed the importance of having experience dealing with cardiac arrest situations as a facilitator to using an AED. It was perceived that lack of exposure to cardiac arrest situations would hinder AED use.

#### 7. *Other tasks to do during resuscitation*

More than half of the participants were concerned with having other tasks that they were responsible for during cardiac arrest resuscitation, and that using an AED represented another task added on to an already overtaxed health care provider. Notably, all



Table 4. Control beliefs		
Code	Frequency	Example quotes
Training on AED	24	<i>Well definitely we need to make sure that everybody knows how to use it properly. A training process. Repetition, of course, this needs a recert for people to review it regularly to make sure they're okay with it. A one shot deal often is not going to be enough. Step by step on the machine is not something that is impossible to do either, just to make sure that in a panic situation people know how to use it properly.</i>
Policy allowing AED use	21	<i>Our monitors are equipped for the AED. It has the setting on it and we have the gel pads, everything, it's just policy. So as a nurse it might be, maybe I'm not sure of it's a controlled act and that would have to be something approved by our college, just saying that that's okay for a nurse to use one...that's the only thing I can think of. On the other hand, having legal issues, having the support of the hospital, we're okay to use it, we support you, it sort of encompasses all that with the policies and procedures. It just helps cover you in any ways.</i>
Familiarity with the AED	21	<i>We're certified once a year, but we don't really see it other than the one time. So that makes it more difficult because we're not familiar with it. It's like anything else you familiarize yourself by seeing it, by playing with it, you know and were not really given that opportunity at this time because it's not on our unit.</i>
Role during cardiac arrest resuscitation	19	<i>That you're the one taking control type of thing. Because right now we go in sure we start CPR and we know someone is coming and everything and they are going to be doing the hands-on and that type of thing and then like I say we kinda step back and the team takes over and they are the ones putting the AED on and saying when to go and that type of thing. For us now to transition to be the first response, to put it on will be a big transition for nurses. You're making a decision that you think that a doctor should be making I don't think you would want, I know in the public anybody can use it pretty much but, um, I think in a hospital setting you've got enough people around that can deal with things that have background. I don't think it should be just any nurse. I think it should be the code nurse.</i>
Machine availability and proximity	18	<i>Well, the fact that it's right there on the unit, so it's available.</i>
Experience with cardiac arrest resuscitation	17	<i>Now whether or not each one of us are going to experience an actual cardiac arrest and yet there's lots of nurses on the floor unit right now that have never been involved in one. So there's that to look at too...so they would be the ones that would back-off and usually other ones that have been involved in a cardiac arrest get involved a little bit more. We are equipped to respond to crisis situations, so I think just to be able to manage a crisis situation, just to be present and functional in a crisis situation is sometimes, I think, the key thing to have. And I believe with the training that we have, we definitely can say that the RTs are capable of working in that type of environment. So to be functional, I think the RTs are reliable for that and the exposure of the equipment is also a big thing. Not to be scratching your head in front of it helps.</i>
Other tasks to do during resuscitation	13	<i>We would have to put aside the intubation a little longer, so it would have to decide, I guess the doctors, do they really want the intubation first or the defibrillation first? It's one more responsibility I guess that the nurse would have to take on and we are already pretty taxed, but you know we do what we have to do.</i>
Trust the AED to work or not	12*	<i>A disadvantage would probably be that if you, suppose there's a malfunction in the machine, that you are trusting the machine and what happens if there's, I don't know, maybe it's reading it wrong or maybe there's something else going on that—cause I find if you've got computers, sometimes the computer overtakes it and you're not actually looking at your patient deciding what's happening. So I don't know, I know they're pretty smart machines but maybe they're not that smart yet.</i>
Litigation as a result of using AED	8	
Support of other health care providers	8	
Confidence during cardiac arrest resuscitation	7	
Patient being wet	3	
Small room size	3	
Patient having a pacemaker	2	
Situation warranting AED use	2	
Using AED will inhibit rest of assessment during cardiac arrest	2	
Patient's position	1	
Comfort with technology	1	
Research supporting AED use	1	
Patient characteristics (e.g., obese, hairy chest)	1	
Inability to increase voltage on AED	1	
Combined AED/manual defibrillator makes using AED difficult	1	

\* > 75% of all codes reached.

of the respiratory therapists we interviewed mentioned being already too preoccupied with managing the patient's airway.

#### 8. *Trust the AED to work or not*

Half of the participants expressed an opinion regarding the proper functioning of an AED. Five mentioned that they would trust the AED to work properly; four were not convinced that they reliably would, and three participants were concerned about malfunction.

## **DISCUSSION**

This qualitative study used the constructs of the TPB to identify the factors influencing the intention of nurses and respiratory therapists to use an AED during in-hospital cardiac arrests. Overall, participants expressed a positive attitude toward AED use. The most common behavioural beliefs identified include timeliness of defibrillation, patient survival, simplicity of AED use, accuracy of rhythm recognition, and harm to the patient, self, or others. Although several subjective norms were acknowledged, including physicians and the hospital administration, these themes were mentioned less frequently than the behavioural beliefs and control beliefs. The most common control beliefs identified consisted of lack of training on AED use, policy allowing AED use, familiarity with the AED, AED availability, and roles during resuscitation.

It is important to mention that, in most institutions, critical care nurses and nurses working in the emergency department can already provide defibrillation during in-hospital cardiac arrests. This is most often resulting from the adoption of a medical directive allowing the use of manual defibrillators rather than AEDs. Our participants included such critical care and emergency nurses. They also shared their respective barriers to AED use and defibrillation.

The themes identified in this qualitative study represent areas to target in order to facilitate policy change and behaviour change regarding AED use during cardiac arrest in both critical care and non-critical care areas of the hospital. Those theoretically derived determinants of participants' intention to use an AED can be mapped to behavioural change techniques to be implemented in a multi-interventional study design.<sup>22</sup> Such an intervention could help clarify how the intention to use an AED (as measured by the TPB constructs) is linked to the behaviour of actually using

one in a cardiac arrest situation, and how nurses and respiratory therapists may differ in their use of AEDs.

Dwyer also published a qualitative study examining the defibrillation-related beliefs of nurses in rural Australia using focus groups and the TPB.<sup>28</sup> Among the 12 recruited participants, 7 were allowed to defibrillate patients, most often using manual defibrillators. Our study found very similar results in discussions with urban nurses and respiratory therapists. Of note, a theme common to both Dwyer's and the current study is the participants' concern regarding the safety and accuracy of AEDs, with their ability to recognize electrical rhythms accurately, and with the perceived potential harm to the user and patients.<sup>28</sup> A number of studies has shown that AEDs can safely be used by both trained health care providers and lay responders,<sup>2,15,29-32</sup> and that they can accurately identify cardiac rhythms.<sup>33-35</sup>

It is also important to consider the potential impact of such an AED program. Chan conducted a multi-centre cohort study of 11,695 cardiac arrests examining the effect of AED use in-hospital.<sup>3</sup> This study reports overall lower survival to hospital discharge with AED use (16.3% v. 19.3%;  $p < 0.001$ ).<sup>3</sup> Chan's study did not find a decreased time to defibrillation with AED use, which may contribute to the overall lower survival. Furthermore, the database/registry used for that study did not specify who was using the AED – nurses and other allied health professionals, or physicians. An AED may delay defibrillation in the hands of a physician due to the time needed for automated rhythm analysis compared to manual rhythm recognition and defibrillation.

## **LIMITATIONS**

The TPB is only one of many existing frameworks to study and analyse behaviour. Although it focuses on the "intention" to adopt a behaviour, the TPB is a rigorous framework very commonly used in health care studies. Qualitative inductive analysis may possibly be influenced by the bias of the investigators performing the analysis. We attempted to limit this bias by having two independent investigators (neither of which were a nurse or a respiratory therapist) complete the analysis and resolve conflicts by way of consensus.

## **CONCLUSIONS**

Most nurses and respiratory therapists would agree to use an AED during in-hospital cardiac arrests if permitted to

do so by a medical directive. Successful implementation would require educational initiatives focusing on safety and efficacy of AEDs, support from physicians and hospital administrators, and additional training on AED use. These beliefs are important to address through future research using appropriately selected behavioural change techniques and policy changes.

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## REFERENCES

1. Mozaffarian D, Benjamin E, Go A, et al. Heart disease and stroke statistics – 2015 update: a report from the American Heart Association. *Circulation* 2015;131:e29-322.
2. Peberdy MA, Kaye W, Ornato JP, et al. Cardiopulmonary resuscitation of adults in the hospital: a report of 14,720 cardiac arrests from the National Registry of Cardiopulmonary Resuscitation. *Resuscitation* 2003;58(3):297-308.
3. Chan PS, Krumholz HM, Spertus JA, et al. Automated external defibrillators and survival after in-hospital cardiac arrest. *JAMA* 2010;304:2129-36.
4. Kleinman M, Brennan E, Goldberger Z, et al. Part 5: adult basic life support and cardiopulmonary resuscitation quality: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2015;132:S414-35.
5. Sandroni C, Ferro G, Santangelo S, et al. In-hospital cardiac arrest: survival depends mainly on the effectiveness of the emergency response. *Resuscitation* 2004;62:291-7.
6. Chehadi W, Vaillancourt C, Gatta M, et al. Review of in-hospital cardiac arrest care processes and evaluation of time delays amenable to automated external defibrillator use by allied health professionals. *CJEM* 2011;13:211 [abstract].
7. Murphy M, Fitzsimons D. Does attendance at an immediate life support course influence nurses' skill deployment during cardiac arrest? *Resuscitation* 2004;62:49-54.
8. Kaye W, Mancini ME, Giuliano KK, et al. Strengthening the in-hospital chain of survival with rapid defibrillation by first responders using automated external defibrillators: training and retention issues. *Ann Emerg Med* 1995;25:163-8.
9. Hamilton R. Nurses' knowledge and skill retention following cardiopulmonary resuscitation training: a review of the literature. *J Adv Nurs* 2005;51:288-97.
10. Mäkinen M, Aune S, Niemi-Murola L, et al. Assessment of CPR-D skills of nurses in Göteborg, Sweden and Espoo, Finland: teaching leadership makes a difference. *Resuscitation* 2007;72:264-9.
11. Service Ontario e-Laws. Legislative Assembly of Ontario Canada Section 27. Regulated Health Professions Act (S.O. 1991, c18); 1991. Available at: [http://www.e-laws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_91r18\\_ethm#BK24](http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_91r18_ethm#BK24) (accessed 8 August 2014).
12. Service Ontario e-Laws. Legislative Assembly of Ontario Canada. Nursing Act (1991, O. Reg. 275/94). Part III – Controlled Acts; 1991. Available at: [www.e-laws.gov.on.ca/html/regs/english/elaws\\_regs\\_940275\\_ethm#BK35](http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_940275_ethm#BK35) (accessed 8 August 2014).
13. Destro A, Marzaloni M, Sermasi S, et al. Automatic external defibrillators in the hospital as well? *Resuscitation* 1996;31:39-43; discussion 43-4.
14. Gombotz H, Weh B, Mitterndorfer W, et al. In-hospital cardiac resuscitation outside the ICU by nursing staff equipped with automated external defibrillators – the first 500 cases. *Resuscitation* 2006;70:416-22.
15. Hanefeld C, Lichte C, Mentges-Schroter I, et al. Hospital-wide first-responder automated external defibrillator programme: 1 year experience. *Resuscitation* 2005;66:167-70.
16. De Regge M, Monsieurs KG, Vandewoude K, et al. Should we use automated external defibrillators in hospital wards? *Acta Clinica Belgica* 2012;67:241-5.
17. Kenward G, Castle N, Hodgetts TJ. Should ward nurses be using automatic external defibrillators as first responders to improve the outcome from cardiac arrest? A systematic review of the primary research. *Resuscitation* 2002;52:31-7.
18. Ajzen I. The theory of planned behaviour. *Organ Behav Hum Decis Process* 1991;50:179-211.
19. Ajzen I. The direct influence of attitudes on behaviour. In Gollwitzer PM, Bargh JA (eds.). *The psychology of action: linking cognition and motivation to behaviour*. New York: Guilford Press; 1996: 173-221.
20. Godin G, Kok G. The theory of planned behavior: a review of its applications to health-related behaviors. *Am J Health Promot* 1996;11:87-98.
21. Bunce D, Birdi KS. The theory of reasoned action and the theory of planned behaviour as a function of job control. *Br J Health Psychol* 2003;3:265-75.
22. Michie S, Johnston M, Francis J, et al. From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychol* 2008;57:660-80.
23. Kelley K, Abraham C. Health promotion for people aged over 65 years in hospitals: nurses' perceptions about their role. *J Clin Nurs* 2007;16:569-79.
24. Edwards HE, Nash RE, Najman JM, et al. Determinants of nurses' intention to administer opioids for pain relief. *Nurs Health Sci* 2001;3:149-59.

25. Godin G. Determinants of nurses compliance to universal precautions. *Am J Infect Control* 2000;28:359-64.
26. Francis J, Eccles M, Johnston M, et al. *Constructing questionnaires based on the theory of planned behaviour: a manual for health services researchers*. Newcastle: Center for Health Services Research; 2004.
27. Francis JJ, Johnston M, Robertson C, et al. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol Health* 2010;25:1229-45.
28. Dwyer TA, Mosel Williams L, Mummery K. Defibrillation beliefs of rural nurses: focus group discussions guided by the Theory of Planned Behaviour. *Rural Remote Health* 2005;5:322.
29. Caffrey SL, Willoughby PJ, Pepe PE, et al. Public use of automated external defibrillators. *N Engl J Med* 2002;347:1242-7.
30. Page RL, Joglar JA, Kowal RC, et al. Use of automated external defibrillators by a U.S. airline. *N Engl J Med* 2000;343:1210-6.
31. Valenzuela TD, Roe DJ, Nichol G, et al. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. *N Engl J Med* 2000;343:1206-9.
32. White RD, Hankins DG, Bugliosi TF. Seven years' experience with early defibrillation by police and paramedics in an emergency medical services system. *Resuscitation* 1998;39:145-51.
33. Dickey W, Adgey AA. Mortality within hospital after resuscitation from ventricular fibrillation outside hospital. *Br Heart J* 1992;67:334-8.
34. Atkinson E, Mikysa B, Conway JA, et al. Specificity and sensitivity of automated external defibrillator rhythm analysis in infants and children. *Ann Emerg Med* 2003;42:185-96.
35. Kerber RE, Becker LB, Bourland JD, et al. Automatic external defibrillators for public access defibrillation: recommendations for specifying and reporting arrhythmia analysis algorithm performance, incorporating new waveforms, and enhancing safety. A statement for health professionals from the American Heart Association Task Force on Automatic External Defibrillation, Subcommittee on AED Safety and Efficacy. *Circulation* 1997;95:1677-82.