

Developing resuscitation programmes in the community: the tasks ahead for the National Resuscitation Council

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ABSTRACT

Singapore has a long way to go to becoming a 'heart-safe' society. Given our small size and culture of hard work in our country, we can achieve a state of good first response by our community citizens through public cardiopulmonary resuscitation and automated external defibrillators training programmes at various key sectors and through the implementation of public access defibrillation in a committed manner. For our second-line responders, investing in technology to improve response times and quality of chest compressions with earlier interventions will go a long way toward strengthening the chain of survival in the community. Building on this strong foundation and having a strong hospital-based cardiac arrest management system will ensure that those who achieve return of spontaneous circulation will more likely remain alive and be discharged from hospital in a neurologically optimal state.

Keywords: ambulance response times, cardiac arrest, life support training, instructors, mass CPR, quality of ambulance care

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INTRODUCTION

Based on the number of cardiac arrest patients managed by the emergency ambulances of the Singapore Civil Defence Force, approximately 1,400 cardiac arrests occur annually in the out-of-hospital environment in Singapore. About 67% of these events⁽¹⁾ occur in residential areas, while the remaining take place in public and work places. Only about 2%–3% of cardiac arrest patients survive till initial hospital discharge. The reasons for this apparently low survival rate are thought to be the following:

- An initial average reaction time of 10.6 ± 15.0 minutes before help is called;
- An ambulance response time from call to arrival at patient's side of 12.6 ± 4.7 minutes;
- A mean call to ambulance crew starting cardiopulmonary resuscitation (CPR) time of 14.4 ± 5.6 minutes

and a call to first shock time of 16.7 ± 7.2 minutes;

- A bystander CPR rate that currently stands at about 20%; and
- A relatively low penetrance of automated external defibrillators (AEDs) in the community.

While efforts need to be made in the areas of hastening ambulance response times and increasing AED usage, one major area that must be addressed is the active promotion of early life support among laypersons, i.e. the creation of a strong cadre of first responders. This paper focuses on the creation and organisation of this crucially important first response.

A VISION OF A HEART-SAFE SINGAPORE

There are a number of communities in the world that have been able to achieve double-digit survival rates for their out-of-hospital cardiac arrests. In order for Singapore to achieve the status of a 'heart-safe' community, the following would be required:

Wide acceptance and use of primary prevention programmes for heart disease

This would require that primary prevention be taught in every life support course. A few minutes spent on explaining clearly to course participants about the need to undertake primary prevention measures must be part of the course content of every life support training programme in the country. Content that is relevant to the theme of primary prevention would include highlighting a variety of measures, such as quitting cigarette smoking, controlling of hypertension through medication, adoption of appropriate healthy lifestyle practices, achieving of good glycaemic control for diabetics through education of patients and their families, as well as treatment of hyperlipidaemia through adopting a healthy diet, regular exercise and medication.

Further sustained primary prevention activities would be outside the scope of the National Resuscitation Council (NRC), and would be better managed by organisations such as the Health Promotion Board, the Singapore Heart Foundation and the medical community in general, where patients are being cared for in the various health centres.

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Table I. Number of individuals needed to be trained in CPR for Singapore.

Groups	Number
11-year-old children in Primary 5 (Grade 5): focus on teaching only chest compressions and importance of life saving	40,000*
13-year-old children in Secondary 1 (Grade 7): focus on teaching ventilations and interfacing with chest compressions	40,000*
15-year-old children in Secondary 3 (Grade 9); certify in citizen CPR	40,000
Junior college students: certify in CPR+AED	20,000
Singapore Armed Forces servicemen/tertiary students: recertify every two years	50,000
Reservist national servicemen: recertified every two years	80,000
Non-national service liable persons: trained at constituency-based and other training centres	230,000
Annual mass CPR events: for those who have missed out on the above training opportunities	80,000
Total no. certified annually	500,000

*These would not be regarded as certified life savers yet, but their training is to facilitate easier formal certification at age 15 years.

Prompt first and further emergency response

This involves ensuring that there is at least one first responder in every household in the country to initiate early and prompt life-saving first aid. This is the target set by the NRC to be attained by the year 2020.

Shorter time periods for second response

This involves working toward achieving second response at much shorter time periods than those currently attained, and ensuring that this level is able to provide quality of care that maximises the chances of return of spontaneous circulation (ROSC) for every cardiac arrest patient in the country. Second responders generally refer to ambulance crew who take over the management of the patient from the first bystander and continue the management until the patient is handed over to a responsible care team in a medical centre.

Resources for optimising opportunities for increasing survival of out-of-hospital cardiac arrest victims

This mainly addresses the third response system for cardiac arrest management in the country, i.e. the hospital staff. They take over the patient from the community second responders, usually the emergency ambulance service, and would be the final group of caregivers who will attempt to resuscitate the patient. Third responders include Emergency Department (ED) doctors and nurses as well as staff from the cardiology and intensive care departments within the hospital who are involved in the provision of advanced cardiac life support and further post-resuscitative care (the fourth link in the chain of survival).

The fourth link has been described in the papers on advanced cardiac life support⁽²⁾ and the post-resuscitation bundle⁽³⁾ in this issue. This paper will address the approach required for a prompt first and further emergency response, i.e. the requirements for an adequate first and second response in the community.

ACHIEVING PROMPT FIRST RESPONSE

As mentioned earlier, this involves having at least one trained and currently certified first responder in every household. Since a time target is usually required for communities to define goals temporally, the NRC has identified 2020 as the year for reassessment of our programmes in order to address measures to improve survival rates for out-of-hospital cardiac arrest in the country.

There are currently about five million residents in Singapore,⁽⁴⁾ living in approximately 1,000,000 households. In order to achieve a state of having one trained first responder in every household, we would need to have one million such currently certified responders at any one time. With a current period of certificate validity of two years, this would mean having to train 500,000 persons annually in the basic core skill of CPR.

Every year, new births in the country account for about 40,000 new residents. The number and groups of people from overseas moving into the country to live and work approximates 10,000 per annum. Thus, at a steady rate, at least 50,000 people would need to be trained afresh every year, and approximately 450,000 would need to undergo two-yearly recertification. Addressing these massive numbers in a small country seems a near-impossible task, especially since our current rate of training is only about 40,000–50,000 per annum. To achieve the goal, we would require a significant shift in the emphasis given to basic core life skills training so that saving a life becomes a part of our national culture. The number and groups of people who would need to be trained are summarised in Table I. The approach that should be taken with the different targeted groups is discussed below. Training through the various channels will have to be institutionalised in the organisations that the groups belong to. While the NRC would need to maintain oversight of the content, quality of training and numbers, it would be necessary for the

conduct of the various sessions to be decentralised in order to achieve control and flexibility in implementation.

A prompt first response also involves the implementation of public access defibrillation programmes in the country. To date, such programmes have been established in only a few areas in the country.⁽⁵⁾ They need to be owned by the community groups, especially the various commercial groups and Town Councils that have been set up to manage the large number of housing estates. The NRC will need to work closely with these organisations in order to create a formula that will ensure that these programmes are effectively maintained. Nationwide implementation of such programmes has been carried out in countries such as Japan.⁽⁶⁾ We should learn from the experience of these communities so as to determine what makes such programmes work.

SCHOOLS

Schools are in the enviable position of being able to influence the minds and behavioural patterns of our future adults. Repetitive teaching and skills training during the developmental years can potentially inculcate in our young the basic consciousness of rendering help, whenever necessary, to someone in trouble, as well as the importance of overcoming their fears of acting quickly to help a fellowman in an emergency. In addition, introducing the necessary skill sets gradually over the years can allow for better entrenchment of these skills into their basic response mindset. Schools exist for the purpose of preparing young people for life. Therefore, it does make sense that all students should learn the basics of life-saving in their developmental years.

There are many studies that support the training of young school children in CPR.⁽⁷⁻⁹⁾ How to implement this training in a smooth and effective manner would be the challenge. There are usually insufficient life support instructors in most communities to train the large number of school students. Some studies advocate the use of school teachers as CPR instructors. King County, Seattle, USA, one of the most successful communities in the world in terms of community CPR training,⁽¹⁰⁾ has achieved a survival rate in excess of 40% for their out-of-hospital cardiac arrests, partly through training their teachers as CPR instructors.

This may also be achievable in Singapore, especially since we have a single institution that trains all teachers in the country. The National Institute of Education (NIE), which is part of the Nanyang Technological University, would be in a position to consider training graduates from the teachers training programmes to the level of CPR instructors. This may be considered, especially if our

Ministry of Education were to indicate the need to train a large number of school teachers as CPR instructors. Such a programme with the NIE as a CPR Instructor Training Centre would produce a few hundred CPR instructors annually, who would then be infused into our schools to begin the training of identified groups of school children in these life-saving skills. The NRC would be able to play a useful role in not only advising the NIE on the training content and methodology, but also in helping to create the texts that could be used by the NIE for training. This would allow the introduction of CPR training into our primary and secondary schools and junior colleges. The number of instructors trained through NIE would eventually address the requirements of instructors in all our schools. Some of these teachers may, in addition, volunteer their services for constituency-based CPR training programmes, which will be discussed later.

A study in the UK has determined that children below the age of 15 years may not be able to perform the psychomotor skills required for resuscitation of adults.⁽¹¹⁾ Experience among CPR instructors in Singapore, however, has demonstrated that Secondary three students in this country (ninth graders) are able to effectively complete an adult CPR training programme and be certified in the relevant skills. To gradually introduce these skills among school children and at the same time inculcate a culture and understanding of the need to save lives whenever the opportunity allows, a step-wise approach can be taken.

1. Primary school students aged 11 years (fifth graders) are first introduced to concepts of life saving, risk factors for heart disease and stroke as well as healthy lifestyles, and taught how to perform chest compressions. This can be done as a half-day programme that includes didactic sessions and skills training. A short evaluation session on the Mini Anne manikin can be included to help imbue the children with a sense of achievement that they can at least do chest compressions.
2. Secondary one students aged 13 years (seventh grade) are introduced to mouth-to-mouth ventilation, the need for oxygen to keep vital organs alive and practical skills training on this procedure. It would be worthwhile to introduce a combination of chest compressions and mouth-to-mouth ventilation skills at this stage, although the assessments should be primarily on the ventilatory component. This stage of training will play a major part in helping students to overcome any reservations regarding intervening or performing mouth-to-mouth ventilation, and will also reinforce and revise the skills of chest compression that they had learnt two years earlier.^(12,13)

3. At the age of 15 years, Secondary three (ninth grade) students would be better able to understand the need for CPR. They will be taught the combined skills of chest compression and ventilation, and be assessed on these two areas. At this stage, the students could also be given an introduction on the use of an AED, as well as its importance in life saving and how it needs to be well interfaced with good quality CPR. This will allow them to become valuable assistants to older persons who are involved in resuscitations. These students can achieve certification as CPR providers, and would be the youngest group to achieve such certification in the country.
4. For students in the junior colleges, the CPR+AED programme could be conducted. These students would have been initially certified in CPR at least two years earlier. Introducing the AED component with concurrent performance of CPR would not only help with revision of CPR skills but also help our junior college graduates to be adept at the use of AEDs. This would be relevant in our community since the penetrance of AEDs is gradually increasing in shopping malls, offices and even housing estates. By this stage, we should have been able to maximise the use of e-learning platforms for CPR+AED education, with the focus on practical skills and addressing doubts that students may have when they come together for the training session and evaluation.

TERTIARY INSTITUTIONS

Our tertiary institutions provide the key to the creation of a large number of CPR instructors who would be the backbone of the CPR movement in the country. Conceptually, we should be training all students of the healthcare sciences and those in the sports and fitness professions to become instructors in the basic skills of CPR+AED. Therefore, all medical and nursing students and those training to be sports instructors should be trained as providers in their first year at the tertiary institution. In their second year, they should go through an instructor training programme.

As mentioned in an earlier section, the NIE will also be one of the institutions covered. Having gone through an instructors' course, NIE students should then instruct twice, under the supervision of a senior instructor, either in one of the provider sessions at tertiary institutions or at the annual mass CPR event conducted as part of our annual National Life Saving Day. Having completed two supervised sessions satisfactorily, NIE graduates should be eligible for certification as instructors. They would be able to retain their status as instructors by teaching two

courses every year, which could include courses conducted at the tertiary institution or any other accredited training centre. Therefore, we should work toward converting all our tertiary institutions to be accredited training centres.

Currently, only a few of the polytechnics have achieved the status of an accredited CPR training centre. It now remains for the universities and the remaining polytechnics to achieve this. Potentially, we could be creating up to nearly 2,000 instructors per annum from this group. Once these trained instructors graduate from polytechnics, there should be an understanding that they will continue to contribute to the national CPR programme by teaching in at least two courses per annum for up to a minimum of five years. Subsequently, they could be encouraged to volunteer with one or more of the available training centres in the country, especially at the various constituencies.

In addition to being sources of instructors, each tertiary institution could make a commitment to train their whole cohort of students to become providers of CPR. To date, the Institute of Technical Education (ITE) has already embarked on this, and some polytechnics have also come forward to try to achieve this for either their first- or second-year students. It is an encouraging development and signifies the commitment of these institutions to the creation of a community of students who are able to intervene in times of acute emergencies at the home, school or workplace. The NRC is working closely with them to achieve this end. The impact of this will be felt in the workplace when these young people join the workforce over the subsequent few years. The challenge for the NRC and these institutions is to maintain the momentum of development and ingrain this programme of core life skills training into our tertiary-level educational system.

CPR AND CPR+AED TRAINING IN THE UNIFORMED ORGANISATIONS

The Singapore Armed Forces (SAF) is the largest uniformed organisation in the country. Every year, almost all the male population of a certain age group would begin a two-year stint as National Servicemen in a variety of uniformed organisations, including the SAF, the Singapore Civil Defence Force (SCDF) and the Singapore Police Force (SPF). This would be a golden opportunity for this group of young men to be trained, retrained or recertified in the skills of CPR and AED use. In addition, there is a small core of regular servicemen in these uniformed organisations. In 2010, the SAF began training all their servicemen in the combined skills of CPR+AED. This was a major achievement, and the conduct of such training was contracted out to public and private NRC-accredited training centres.

However, once-only training of our servicemen would be inadequate to address future needs. In addition, there is the matter of attrition of knowledge and skills with time. A system of refresher training and two-yearly certification should be built into the CPR+AED programme of these uniformed organisations so that National Servicemen would undergo refresher training at least four times during their reserve training cycle. It takes only half a day (maximum of four hours) to undergo refresher training and recertification assessments in CPR+AED. These uniformed organisations will need to carefully study how they can be built into training programmes when servicemen report for their annual reservist. The NRC is ready to work with the uniformed organisations and training centres to facilitate the conduct of these refresher and recertification programmes. Having half the population of Singapore undergo such training at least five times in their lifetime, if not more, will go a long way toward ensuring that these practices become well entrenched into the culture of our society.

Facilities that may be considered as future training and certification centres for these servicemen would be the SAF Reservist Association (SAFRA) and Home Team Clubhouses in the country. The logistics of using these facilities for our servicemen can be worked out. They may also be used as training areas for our reservist servicemen to practise and polish up their skills in these vital life-saving procedures.

CONSTITUENCY-BASED CPR AND AED PROGRAMMES

Training the other 230,000 members of the community who are neither students in schools or tertiary institutions nor in the uniformed services would be a major challenge for any small country.^(14,15) These would include the female population, migrants who do not have military service liability and males who are past the reserve liability period. One would have to look at the organisational structures that are accessible to residents all over the country. The framework that may be able to reach out to all residents would be our community centres and the current accredited training centres in healthcare institutions and the community.

Generally, each constituency in Singapore has either a community centre or a community club, where members of that residential area could gather and partake in group activities. With the number of constituencies expected to number 87 soon, we could look toward establishing Citizen Life Support Training Centres in each of these constituencies. Two pilot centres have been established so far; one at the Jalan Kayu Constituency of Ang Mo Kio

Group Representation Council (GRC) where a combined Citizen CPR and Citizen First Aid programme (the Jalan Kayu FACTs programme) has been established and the other at the Tanglin-Cairnhill Constituency of the Tanjong Pagar GRC where a combined CPR+AED programme (Henderson Heartbeat) has been started. Getting these projects off the ground involved active discussions with a number of community grassroot organisations in order to gain their support and patronage, so that these programmes may become entrenched in these areas. The Jalan Kayu FACTs programme has involved instructor training of both residents in the constituency and medical students living in and around the vicinity of the constituency. To date, at least 400 residents have been trained as a result of this programme. The Henderson Heartbeat programme has trained more than 200 individuals in CPR+AED and has also deployed AEDs in the elevator lobbies of high-rise apartments and at the community club and market place.

Although we are still in the early days of these programmes, the quality of the training being carried out at these two pilot sites matches that being done in other training centres in the country. Accrediting these centres will mean that residents would be able to look forward to nationally recognised and certified training programmes just at their doorstep. A well set up project in a constituency can train up to about 1,000 persons per annum in these highly skill-based programmes, which include assessment of participants in essential theoretical knowledge and skills in these life-saving procedures. With 87 such centres, we should be able to train at least 87,000 persons every year as a result of the constituency-based programme. Assuming that each instructor conducts four training sessions per annum, and each instructor session is able to train up to six persons, up to 3,625 active instructors would be required for this programme. Potential sources of instructors could be medical and nursing students trained up to instructor level, graduate doctors and nurses who wish to contribute their life-saving training skills to the community that helped to train them, and also volunteer instructors from other training centres. The maintenance of these instructors would have to be undertaken by the individual training centres. The administrative support for the programme would have to come from the individual constituency offices. This, being a major undertaking, would provide tremendous scope for parent community organisations, such as the Peoples' Association, to ensure that over-riding supervisory framework needed for success is available.

Training the remaining 143,000 members of the community would fall upon the shoulders of the currently accredited non-constituency-based training centres, which would train an average of 2,400 persons per annum, an

Table II. Instructor requirements for CPR training in Singapore.

Source of potential instructor	Number
Every medical student trained to level of instructor	1,000
Every nursing student trained to level of instructor	2,000
Active graduates from medical/nursing schools*	900
School teachers	3,000
Training centres	3,000
Total	9,900

*This constitutes about 30% of all local medical/nursing graduates.

increase from the current average of 1,200. To achieve this, a minimum of at least 60 such training centres are needed. We have currently accredited nearly 40 centres in various parts of the country. The NRC will continue to encourage the setting up of well-managed and accredited training centres that are willing and able to reach out to the various sections of society so as to address the need for first responder training and life saving in the country. The total number of instructors needed to manage this large number of potential lifesavers is about 2,400. To date, we have trained slightly more than 1,000 instructors to teach in these various training centres. The challenge for the Instructor Training centres would be to open up their programmes to achieve a doubling of the instructor pool for their various centres. Currently accredited training centres may also wish to adopt residential areas in the vicinity of their locations so as to reach out to residents and begin community life support training programmes, especially during the weekends when these centres would otherwise be closed and equipment and personnel not optimally utilised.

The NRC is also looking at setting up CPR and CPR+AED training kiosks within the constituencies. Each kiosk would consist of a training manikin mounted on a slab, with voiced step-by-step instructions to any person who visits the kiosk. Around the kiosk would be displayed step-by-step instructions on the skills of CPR and CPR+AED. The kiosk would allow any member of the public to register on the manikin, conduct his self-practice guided by the programme built into the kiosk, take the theory and even the practical test. It would also provide feedback on the quality of CPR performed by the visitor and allow the generation of a certificate. It is hoped that the setting up of such kiosks would make CPR training more accessible to the masses and increase the numbers trained and certified in this skill.

MASS CPR EVENTS

Over the last 25 years, a number of mass CPR events have been held in Singapore to increase awareness for

the need for CPR training in the community. These events usually involved members of the public getting together and demonstrating the skill as a group. Usually, most of these events have seen attendances ranging from a few hundred to a few thousand. On 16 January 2011, at an event jointly organised by the NRC, Singapore Heart Foundation, Singapore Sports Council, ITE and the Peoples' Association, a total of 7,909 people were trained in CPR at a single venue, establishing a world record for the largest number of individuals trained at a single venue on a single day. Notably, this was probably the first time anywhere in the world that so many people had been assessed and certified in this core life-saving skill. A total of 960 instructors helped to make this possible on that day.

Mass CPR events will continue to be carried out. Due to their potential for creating awareness among the masses, the NRC will continue to organise these and aim to eventually train up to 80,000 persons per annum through this mechanism. Such events are also occasional opportunities for NRC to gather all instructors together at a single venue and demonstrate the tremendous community contribution these people can make in trying to save lives. As we increase the number of instructors trained through the various channels identified, the ability to organise very large mass CPR events will increase. There is a need for a venue with adequate size to manage the large numbers, the coordination, logistics and training manikins, as well as for organisations to be willing to partner NRC and help fund such major impact events.

ADDRESSING THE NEED FOR INSTRUCTORS

Table II shows the number of instructors that may be generated and their sources. There is a need to ensure that in moving forward with the generation of a large number of instructors for the country, training standards are emphasised and the need for such teachers to be appreciated and not forgotten. Getting those who come from our medical and nursing schools to contribute for a minimum duration of a few years after graduation may need to be considered. Society tends to look up to its healthcare workers. Thus, having a large pool of such workers displaying their keen interest and using their role as trained instructors to help members of the public help themselves will potentially be a major positive factor in driving the national CPR training programme. The leadership by the medical and nursing professions in driving the life-saving movement in the country will surely enhance their standing significantly in the eyes of their present and future patients. It is hoped that many more from the healthcare professions will continue to provide such training on a regular basis as a form of continuing service to the community.

As mentioned earlier, another very large pool of instructors can come from the teaching profession, those specially trained to impart knowledge and skills. They have a major role to play in shaping the attitudes in the community. The promotion of community self-help by this major and important group of professionals will also help to further raise their profile. The other members of the community will contribute the remaining pool of instructors. Good training systems will help to sustain these large numbers. The NRC will work closely with these various groups so as to move toward these numbers and continue to engage them in many ways to drive the national life-saving agenda.

THE SECOND RESPONDERS

The second responders consist of the crew of the emergency ambulance service of the SCDF. Due to our second responders, about 30–40 lives are saved from cardiac arrest in the out-of-hospital environment annually. This has primarily been a result of the introduction of AEDs into two emergency ambulances in 1989 and their subsequent extension to all SCDF ambulances in 1994. However, there are currently only 36 ambulances that are AED-equipped and serving cardiac arrest patients in the country. Recently, up to ten private ambulances were fitted with similar devices and may also be taking on cardiac arrest patients. Singapore has more than 80 private ambulances. If each of these could be equipped with an AED, this will potentially allow the creation of more emergency second responders. Increasing the number of fast-response motorcycle-based paramedics will also decrease the response time for cardiac arrest management. These various interventions could all contribute to achieving a sub-six-minute ambulance response time, which will effectively halve the current timing. This will likely improve survival rates for out-of-hospital cardiac arrest.

There is also a need to have AEDs placed in all high-rise and public buildings. We should also work toward training all ground staff of these buildings in the core skills of CPR and the use of AEDs so that the first response at these sites is significantly improved. In some countries, such as the USA, federal laws require the presence of AEDs in such areas. Although this is not a mandatory requirement in Singapore, education of building owners on the need for such a device would be an important step. It would also be in the interests of the community if every medical clinic, including those run by General Practitioners, is equipped with an AED and its medical and clinic staff are currently certified in its use. A lighted sign outside an AED-equipped clinic could indicate the availability of the device there, thus providing a clear indicator for local residents in the

event of a medical emergency. AEDs may also need to be placed in every fire engine, police patrol car and taxi. Better still, it could be a requirement that every driver be currently certified in these skills in order to obtain a taxi license. To ensure that all AEDs are used as effectively as possible, it could be a requirement for all such devices used in public areas to have CPR feedback devices to better ensure the practice of quality CPR and also a metronome function to allow for optimal compression rates.

Second rescuers function in difficult circumstances. Often, they need to locate their patients as quickly as possible. Singapore has approximately one emergency ambulance for every 120,000 population, with an average response time of about 11 minutes. Owing to the generally high-rise location of the majority of our patients, a few additional minutes are taken up accessing these upper floor areas. After taking over the casualty and initiating CPR, the patients have to carry through the corridors, down narrow elevators, sometimes down staircases until the ground floor before loading them onto the ambulance. During this transition, it would be almost impossible to provide any meaningful form of CPR. Once the casualty has been loaded onto the ambulance, the rescuers continue CPR. However, once the vehicle begins to move, it becomes a relatively unstable environment for the ambulance crew at the back of the vehicle to provide quality CPR.

We are looking at the use of mechanical CPR devices that may be used by ambulance crew from the time of their first contact with the cardiac arrest patient until the patient is handed over to the receiving hospital's ED. Mechanical CPR devices can be used together with defibrillation pads. The use of such devices may also free up the crew to perform other crucial resuscitation functions that could enhance survival. It is hoped that the early use of such devices would result in a consistent standard of CPR that is in keeping with current resuscitation guidelines. Such good quality CPR applied as early as possible by ambulance crew would, hopefully, lead to an increased rate of ROSC and hence, a greater rate of survival to hospital discharge. In the near future, we will also consider other interventions that may potentially have a positive impact on survival, such as use of impedance threshold devices and even the initiation of therapeutic hypothermia at the time of first contact with the cardiac arrest patient in the pre-hospital environment instead of after ROSC in the hospital. Our second responders care for our cardiac arrest patients during the crucial 15–30 minutes after the first contact with the patient until they hand over to the ED. Optimising care with efficient circulation and ventilation during these crucial periods can help to improve the outcomes of out-of-hospital cardiac arrest patients.

THE THIRD RESPONDERS: HOSPITALS

The role of hospitals in providing advanced cardiac life support and post resuscitative care has been highlighted in earlier sections of this journal. It should be emphasised that third responders can do their job best if the first and second responders have done good for the patient. The NRC will need to work closely with hospitals, not only in the areas of basic and advanced life support training, but also in addressing the issues of quality of resuscitations and post-ROSC care in the in-hospital environment, so that improvements may be made system-wide for better patient outcomes. Therefore, there needs to be oversight in hospitals that are implementing the principles of post-ROSC care, such as therapeutic hypothermia, good glycaemic care, early percutaneous coronary intervention and early goal-directed therapy, whenever required. If we are to truly address the needs of hospitals, implementation of a standardised in-hospital reporting system for cardiac arrest in the Utstein style may need to be mandated.

DATA-DRIVEN MANAGEMENT OF THE NATIONAL LIFE SUPPORT PROGRAMME

Rational planning for provision of an optimal programme to address the needs of cardiac arrest patients is best driven by good data. Therefore, data is required on cardiac arrests occurring in-hospital and out-of-hospital. The types of information required include demographics, locations, medical background, response characteristics, types of interventions and outcomes. This allows planners to determine the areas of weakness in the cardiac arrest management system that need to be addressed, and also helps to evaluate the impact of a variety of interventions. Standardised protocols for reporting of cardiac arrest in both in-hospital and out-of-hospital environments are already available. Adoption of these standardised formats can go a long way in defining the status of care in these areas and allow for focused interventions to ensure best outcomes. All such data captured can be organised in a National Cardiac Arrest Registry. The NRC will be an obvious body to house such a registry so as to ensure a system of oversight of all cardiac arrests occurring in the country. The Registry will be a powerful interventional tool for change management and will also form the basis of good clinical and epidemiological research on cardiac arrest in Singapore.

CONCLUSION

Singapore has a long way to go to achieve good outcomes for her cardiac arrest patients. Good data will help to drive

not only the various interventions in this area, but also the commitment to training, setting of national targets and getting identified groups to assume leadership in the educational process. Bold infrastructural changes, such as those needed for AED deployment, will have to be in place for effective first response. Technological advances need to be brought to bear on second-line responders in order to improve the efficiency of their interventions. In addition, hospitals require strong resuscitative oversight in order to be capable third responders. All these ingredients, overseen by a National Council that is given the mandate to effect change for the better, will be the direction for Singapore.

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