Cardiology in the Young

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Automated external defibrillators and basic life support practices in secondary schools: a nationwide study

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Brief Report

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Abstract

Aim: Cardiac arrest prevention in schools has recently gained momentum. The survival benefit in schools who have access to defibrillators is clear, with far better survival outcomes in children or adults who sustain a cardiac arrest on school grounds. The main objectives of this study were to assess sudden cardiac arrest prevention in Maltese schools, specifically the availability of defibrillators and staff competence in delivering resuscitation. *Methodology and results:* An online-based questionnaire was distributed to all secondary schools across the Maltese archipelago. Data were collected, tabulated, and analysed using SPSS V.23. Most schools (n = 40, 74.1%) completed the questionnaire. Two schools documented a cardiac arrest in the past 10 years. 87.5% agreed that cardiac arrest prevention is an important health topic. Most have a defibrillator on the premises (n = 37, 92.5%). Only one defibrillator is usually available (n = 27, 75.0%). Despite the majority claiming its ease of accessibility (n = 35, 97.2%), most were not available on every floor (n = 37, 97.2%). Only one-third were close to a sporting facility (n = 11, 30.6%). Schools do not organise regular resuscitation courses (n = 21, 58.3%), with eight schools having five or more certified staff members (23.5%). The number of defibrillators did not influence the frequency of resuscitation courses at school (p = 0.607), and there was no association with the number of certified individuals (p = 0.860). *Conclusion:* Defibrillators are not readily available at secondary schools and are often installed in low-risk areas. Most schools have only one staff member certified in resuscitation. These factors should be addressed with urgency.

Sudden cardiac arrest accounts for 15–20% of all deaths worldwide.[1] Several studies have demonstrated that prompt recognition of a cardiac arrest, early cardiopulmonary resuscitation, and defibrillation confers substantial survival benefit for out-of-hospital sudden cardiac arrest. Indeed, a 41–74% benefit has been reported when cardiopulmonary resuscitation training is administered within 3–5 min of collapse.[2–7] A 7–10% decline in survival for every minute that defibrillation is delayed has prompted several health organisations to encourage the installation of automated external defibrillators in major public areas.[8–10] Most sporting organisations also mandate automated external defibrillators in sporting arenas. [11,12]

The sudden death of a young individual is a devastating tragedy for family and friends, stirring deep emotions and raises concerns about the vulnerability of other children and adolescents in society. Sudden cardiac death is a rare phenomenon, with 8–12 young healthy individuals passing away every week in the United Kingdom.[13] Retrospective registries that record sudden cardiac death in young athletes and non-athletes estimate an incidence rate ranging between 0.1 and 6.8 deaths per 100,000 young individuals.[2,13–18] This is probably an underestimate as no mandatory reporting systems currently exist. The prevalence is regrettably hard to establish due to heterogeneity in study methodology and populations studied.

The effectiveness of early cardiopulmonary resuscitation training and defibrillation has also been demonstrated in young individuals. Several cases of successful resuscitation of students during athletic events and functions held at high schools and colleges have now been reported.[3,19–21] Politicians and school administrators are increasingly recognising that this is an important public health concern. The availability of automated external defibrillators in schools is now on the rise in many countries including locally in Malta. Several countries have also created a legal framework to facilitate this process. Automated external defibrillators in most schools are now obligatory in one-third of United States of America states since February 2016.[22] They are endorsed by the Department of Education in the United Kingdom.[23] However, implementation is nation dependent. Most secondary schools in London do not have an automated external defibrillator readily available,[24] whilst an Italian bill outlining the obligatory installation of automated external defibrillators in schools has been approved in 2021.[25] To date, the Ministry of Education in Malta has not yet endorsed nor provided any relevant

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recommendations to schools. There is also no legal framework to support the installation of automated external defibrillators in public places, hence this study.

All adolescents attending Year 5 secondary school classes in Malta (mean age 15 years) were invited to undergo cardiac screening that included a physician-led assessment together with ECG acquisition in schools. This BEAT-IT programme was a first of its kind, effectively screening 0.6% of the entire Maltese population. Nine (0.3%) students were given a diagnosis linked to sudden cardiac death, and another 27 (1.0%) are under surveillance because of symptoms and/or a pre-clinical pathological ECG findings.[26] These outcomes led to a local awareness campaign regarding cardiac arrest prevention and heart disease in young individuals. Early defibrillation and the chain of survival are heavily dependent on automated external defibrillator availability and good cardiopulmonary resuscitation training. Device location and the number of automated external defibrillators installed in schools are key players in this process. Cardiopulmonary resuscitation (CPR) training and recertification are also vital. The main objectives of this study were to evaluate these factors, primarily a) assessing CPR competence and certification amongst school staff, together with b) automated external defibrillator availability in all secondary schools in Malta and Gozo.

Methodology

A cross-sectional study among secondary schools in Malta and Gozo was conducted between March and November 2020. A quantitative written survey was distributed electronically to all heads of schools or school nurses (where available). This consisted of 16 questions, comprised of three main sections a) school details, b) automated external defibrillators availability, and c) basic life support competence amongst staff. Geographic districts were applied as defined by the Malta National Statistics Office.[27] Data were recorded as categorical variables or as a Likert scale (where relevant).

Ethical Approval

This study conforms to the principles stated in the Declaration of Helsinki and was approved by the University of Malta Research Ethics Committee (UREC updated approval 34/2017). Approval was also obtained from the Ministry of Education.

Statistical analysis

Computations were performed using SPSS *V*.23 (IBM, Armonk, New York, United States of America). Categorical variables were presented as frequencies and percentages. Chi-squared test was used to compare groups. A p value of < 0.05 was considered statistically significant.

Results

Forty out of 54 schools (74.1%) completed the questionnaire. Most schools catered for mixed genders (57.5%). The majority were in the Northern Harbour district (37.5%). Two schools (5.0%) had a documented sudden cardiac arrest in one of their pupils in the past 10 years, one on school premises. The majority (n = 35, 87.5%) agreed that sudden cardiac arrest prevention is an important health concern (Table 1). Almost all schools favoured a systematic cardiac screening programme in schools (undecided n = 1, 2.6%; agree n = 9, 23.7%; strongly agree, n = 28, 73.7%).

Table 1. Introductory questions

School Characteristics	Frequency (%)
District	
Southern Harbour	9 (22.5)
Northern Harbour	15 (37.5)
South Eastern	3 (7.5)
Western	5 (12.5)
Northern	4 (10.0)
Gozo	4 (10.0)
Gender	
Male	10 (25.0)
Female	7 (17.5)
Mixed	23 (57.5)
Recorded Sudden Cardiac Arrest in School	
Yes (Both Pupils)	2 (5.0)
No	38 (95.0)
Do you agree that Sudden Cardiac Death prevention is important?	
Strongly disagree	3 (7.5)
Disagree	0 (0.0)
Undecided	0 (0.0)
Agree	2 (5.0)
Strongly agree	35 (87.5)

The next section of the questionnaire addressed automated external defibrillator availability (Table 2). The majority have heard of an automated external defibrillator and its function (n = 39, 97.5%). Most schools are equipped with an automated external defibrillator (n = 37, 92.5%). Only one automated external defibrillator on site is typically present (n = 27, 75.0%). Most schools reported that their automated external defibrillator/s were in an easily accessible area (n = 35, 97.2%), defined in this study as "an area of no further than a 2-minute brisk walk from places in which they were likely to be used." Despite this, almost half of the schools did not have a risk assessment prior to automated external defibrillator installation (n = 17, 47.2%). This consequently led to automated external defibrillators not being available on every floor in most (n = 37, 97.2%) and not being close to a sporting facility in almost one-third (n = 11, 30.6%).

History of sudden cardiac arrest in a school pupil did not have any influence on the availability of automated external defibrillator ($p = 0.860$) or proximity to a sporting facility ($p = 0.722$). History of sudden cardiac arrest at school did not positively influence the number of installed automated external defibrillators (≤ 1 versus ≥ 2 automated external defibrillator, $p = 0.413$), but there seemed to be a direct relationship between history of sudden cardiac arrest at schools and automated external defibrillator availability on every floor ($p = 0.056$). More automated external defibrillators on school grounds did not influence the likelihood of device installation close to a sporting facility ($p = 0.432$). This was also independent of pupil gender ($p = 0.691$) and school location ($p = 0.222$).

Most schools do not organise regular cardiopulmonary resuscitation training courses (n = 21, 58.3%) (Table 3). The majority have staff certified in life support (n = 35, 89.7%). A quarter of schools report more than five certified staff members (n = 8, 23.5%), and the majority have undergone recertification (n = 28, 82.4%). The number of automated external defibrillators on site did not increase the likelihood of having cardiopulmonary resuscitation training courses organised at school ($p = 0.607$). Additionally, there was no association between the number of

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Table 2. Automated external defibrillators in secondary schools

Automated External Defibrillator availability	Frequency (%)
Have you ever heard of an automated external defibrillator?	
Yes	39 (97.5)
No	1 (2.5)
Are you aware what an automated external defibrillator is capable of?	
Yes	39 (97.5)
No	1 (2.5)
Is there an automated external defibrillator present on school premises?	
Yes	37 (92.5)
No	3 (7.5)
How many automated external defibrillators are present in schools?	
1	27 (75.0)
2	5 (13.9)
3	2 (5.5)
4	1 (2.8)
> 5	1 (2.8)
Are automated external defibrillators (if present) serviced regularly as advised by the manufacturer?	
Yes	34 (94.4)
No	2 (5.6)
Is the automated external defibrillator located in easily accessible areas?	
Yes	35 (97.2)
No	1 (2.8)
Is there an automated external defibrillator on every floor?	
Yes	1 (2.8)
No	35 (97.2)
Is an automated external defibrillator located close to sporting facilities?	
Yes	25 (69.4)
No	11 (30.6)
Were all automated external defibrillator locations subjected to a risk assessment prior to installation?	
Yes	19 (52.8)
No	17 (47.2)

certified staff members and the number of installed automated external defibrillators ($p = 0.806$).

Discussion

The prevalence of sudden cardiac death in children and adolescents at schools is low,[28] yet 5% of schools actually had a sudden cardiac arrest recorded. Up to 79% of cases are witnessed,[2] 77% receive bystander cardiopulmonary resuscitation training.[7] The survival rate is far better when defibrillators are readily available in public places.[4,19] Numerous international bodies are not in favour of automated external defibrillator installation in public areas.[8,23,29] The hospital survival rate after sudden cardiac arrest in schools equipped with an automated external defibrillator is 70% when compared to 8% in the overall population of school age children.[19,22] Shockable rhythms are often present at presentation, an important factor in determining outcome.[3] Most schools in this cohort acknowledge that sudden cardiac arrest prevention is an important health topic (92.5%). The majority (92.5%) have at least one automated external defibrillator installed on school premises, substantially better than the results reported in a study carried out across schools in London (28.0%).[24]

Table 3. Cardiopulmonary resuscitation competence and certification

Cardiopulmonary Resuscitation competence and certification	Frequency (%)
Does the school organise regular (annual or more frequent) cardiopulmonary resuscitation training courses?	
Yes (not including automated external defibrillator)	6 (16.7)
Yes (including automated external defibrillator)	9 (25.0)
No	21 (58.3)
Are school staff certified in basic/intermediate/advanced life support at school?	
Yes	35 (89.7)
No	4 (10.3)
How many staff members are certified life support providers?	
1	6 (17.7)
2	8 (23.5)
3	8 (23.5)
4	4 (11.8)
> 5	8 (23.5)
Have they undergone recertification as recommended by the body delivering this certification?	
Yes	28 (82.4)
No	6 (17.7)

Location and availability of installed automated external defibrillators are also important factors. Sports facilities and play areas are known high-risk areas for sudden cardiac arrest in young individuals.[28,30,31] Despite 52.5% of schools in this study claiming a risk assessment was conducted prior to automated external defibrillator installation, most schools do not have an automated external defibrillator on every floor (97.2%). A significant proportion (30.6%) do not have automated external defibrillators installed close to sporting facilities. This is a major public health concern as this may substantially prolong time to defibrillation. Most have at least one staff member certified in life support (89.7%), yet schools do not often organise life support courses (58.3%). This highlights that some staff members have taken this on themselves, rather than relying on the institution to support such initiatives. Basic life support training programmes for students are unfortunately not part of the education curriculum locally, a service which is often included in curricula internationally.[24,32]

Limitations

The study was a cross-sectional study. Data were unfortunately only collected from heads of schools or school nurses, heavily relying on a single individual for a school assessment. The availability and number of installed automated external defibrillators are typically dependent on the number of pupils. This was not addressed in the questionnaire so as not to risk jeopardising confidentiality.

Conclusion

Schools do not only offer education to students. Students also gather for social and sporting events. Sport complexes are often used by sporting clubs or communities for various athletic activities. The vast number of individuals making use of these facilities certainly increases the likelihood of a sudden cardiac death, which is why automated external defibrillator availability and individuals competent in life support is of paramount importance. This study highlights that despite our best efforts, several key factors in

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Maltese schools still need to be addressed in order to improve the chain of survival.

A multifaceted approach to address cardiac arrest prevention in public communities is required. Defibrillator availability is only the tip of the iceberg. Stigma and perception in society are key factors in this important health topic. Educating the young community should be at the forefront of any national cardiac arrest prevention strategy. Teaching basic life support to the young community is a must. Robust legislation would strongly pave the way towards policy implementation, as in the newly approved Italian law.[25] The SportAct framework should also be extensively revised, including sections on the well-being of the athlete and cardiac arrest prevention.[33] The outcomes of this study are the first to objectively assess the current pitfalls in cardiac arrest management in schools.

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