Success of Surf Lifesaving Resuscitations in Queensland 1973-1992

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Med J Aust 1995;163:580-583.

ABSTRACT

Objective: To describe resuscitation results and data from Queensland Surf Lifesavers in years 1973-1992.

Design: Resuscitation forms are completed by Australian surf lifesavers after each incident requiring some form of resuscitation. Forms from Queensland Surf Lifesaving from 1973-1992 were entered on a computer database, and a retrospective analysis made.

Setting: Fifty-four (at that time) beaches patrolled by Queensland Surf Lifesavers, and nearby areas.

Outcome measures: Reasons for resuscitation; victims ages and sex; rescue and resuscitation figures inside and outside patrolled areas, during and outside patrol times; distances of resuscitation sites from beach patrol bases and their success rates; reasons and success rates for resuscitation; victims' facial colour at first assessment; incidence of vomiting, airway difficulties; face mask use and alcohol ingestion were recorded.

Results: Queensland surf lifesavers completed 171 case reports on victims needing resuscitation from 1973-1992 . Eighty percent were males, 20% females - an unchanging ratio throughout data extraction. Resuscitation outcome differed with age, middle-aged being least successful; of the 16.7% of cases occurring within patrolled areas, during patrol hours, 95.2% were successfully resuscitated, whereas in the 54.8% of the cases outside patrolled areas, during patrol hours, just 62.3% were successfully resuscitated (P=0.004); successful resuscitation rates fell with increasing distance from surf club (p=0.009). Reasons and success rates for resuscitation were: immersion 70% (success rate 67.9%), collapse 22% (success rate 47.1%), surf injury 7% (success rate 100%) and beach injury 1% (success rate 100%). The victim's facial skin colour on initial presentation predicted the outcome (p=0.003); if victim's face was a `normal' colour 75% of victims were resuscitated, if pale 77%, if blue 69%, but only 39% if grey-coloured. Vomiting or regurgitation occurred in 55% of all cases - 56% being successfully resuscitated compared to 78% success with no vomiting. Vomiting occurred in 65.4% of immersed victims (resuscitation success 58.8% compared to 80.6% no vomiting) and 40% of collapse victims (resuscitation success 38.8% compared to 60% no vomiting). Alcohol was smelled on the victim's breath by rescuers in 21% of the total cases.

Conclusions: Despite the recent dramatic increase in numbers of visitors and bathers in Queensland, surf lifesavers, with their high standard of training seem to have prevented rescues and resuscitations increasing in proportion. To reduce rescues and resuscitations, public awareness of the dangers must be increased - "bathe between the flags" - the area patrolled by surf lifesavers, is effective advice.

INTRODUCTION

In 1902 William Gocher first defied an Australian law stating there should be no bathing during daylight hours. Shortly after this the law was changed, and as Australia has excellent beaches and surf, often close to large population centres, surf swimming quickly became a popular pastime. By 1907 many people had drowned in the surf, and it became obvious that help was needed. The New South Wales Surf Bathers Association was formed, which later became the Surf Life Saving Association of Australia. This title was changed in 1991 to Surf Life Saving Australia (SLSA).

Referred to by Prince Phillip, Patron of Surf Life Saving Australia as "the greatest community organisation in the World", SLSA provides patrols on the beaches of Australia by volunteer “surf lifesavers”. To become a surf lifesaver, candidates must be over 15 years of age and gain their "bronze medallion" before they are allowed to patrol the beaches (13 & 14 year olds can obtain a lesser award and are able to assist patrolling lifesavers, but must be under the charge of SLSA bronze medallion holders).

To gain the bronze medallion candidates must learn and be examined in basic first aid, resuscitation, use of oxygen therapy, rescue techniques, use of radios and signals, and “surf awareness” - knowledge of some causes and solutions to problems associated with bathing in surf conditions. Every year at the beginning of each season, they are re-examined in these techniques before being permitted to again patrol. This produces some of the most proficient non-medical personnel in cardiopulmonary resuscitation (CPR) in Australia. Further SLSA training is available in advanced resuscitation using oxygen and mechanical ventilation apparatus. The "Oxy-Viva" with the RM (Royal Melbourne) oxygen pressure delivery valve (and anaesthetic face masks for child and adult) was first used by surf lifesavers in the early seventies but was replaced by a mask and self-inflating air bag with valves, in the late eighties. With further training some members develop more advanced resuscitation skills and crew specialist rescue craft such as helicopters and jet rescue boats.

The majority of surf lifesavers however, patrol the beaches around some 255 Surf Life Saving Clubs (SLSC) in Australia on weekends and public holidays during the warmer months of the year. In Tasmania the season may be only a couple of months annually, but in Queensland with its warm climate and extended tourist season, the beaches are patrolled on weekends and public holidays for almost eight months of the year by Surf Club members. Some are patrolled at other times by specialist services and professional lifeguards.

The patrol hours also vary. In southern Queensland on the Gold and Sunshine Coasts, they may start at 0700 and continue until near dark - usually whilst people are on the beach and may go swimming. However, many surf lifesavers live in Brisbane, and at the weekends stay on the coast in the Surf Club dormitories and consequently may be called upon for rescue or resuscitation at any time. The time for patrol also varies according to local needs. Again, at certain times (school holidays, public holidays) the patrols may be expanded to include patrols on every day.

In addition to regular surf rescues and resuscitation, surf lifesavers may be called to resuscitate people up to several kilometres from the Surf Club. These reports include resuscitation for injuries after cliff falls, after electrocutions and heart attacks at home, in shopping centres and car parks, two "cot deaths" and even a hanging.

METHODS

After each incident rescuers are required to fill out detailed resuscitation report forms. The forms used for data extraction have had only one minor change since they were first introduced in 1972. This information was entered into a computer data base and analysed.

The statistical package Intercooled Stata 3.1[1] was used to perform chi-square tests. The p values in the text of this paper refer to Chi-square tests[2] unless otherwise stated. The same package was also used to perform logistic regression analysis[3] and produce odds ratios for resuscitation success versus distance from the clubhouse.

RESULTS

A total of 171 reports were collected, some of which were not complete. The outcome of 170 of the 171 attempted resuscitations was available. Sixty-seven percent (113) of these resuscitations were regarded as successful (the victim was handed over to other medical care with a pulse and breathing).

Gender was available for 167 of the victims. Of these, 80% (134) were male and 20% (33) were female. Although a slightly higher proportion of females than males were successfully resuscitated, the difference between the sexes was not significant (p=0.198). The likelihood of a successful resuscitation did however, vary significantly with age (p=0.003) with success rates particularly low for the 45-64 year old age bracket (FIGURE 1).

There were an average of just under 9 resuscitations per year reported by surf life savers for the period 1972 to 1992. The least number of resuscitations reported for any one year was 3 in 1992 and the maximum was 16 in 1988.

Reasons for resuscitation

In this series the most common reason for resuscitation was immersion (70%), followed by collapse (22%), an injury in the surf (7%) and an injury on the beach (1%). Resuscitation rates versus the reason for resuscitation are shown in Table 1. The small number of injury cases included in the series were all successfully resuscitated. Because of this lack of variability, resuscitation success rates are only considered for injury cases where the distribution of cases across categories may be of interest.

Table 1
Resuscitation success versus primary reason for resuscitation (n=156)

PRIMARY REASON FOR RESUSCITATION	SUCCESS RATES FOR RESUSCITATION
Immersion	67.9% (74/109)
Collapse	47.1% (16/34)
Injury in surf	100% (10/10)
Injury on beach	100% (2/2)

Patrolled areas
Only 16.7% of resuscitations took place during patrol hours, within the flags delineating the patrolled area, whilst 54.8% of the resuscitation cases occurred outside the flags. Data on the actual number of rescues that occurred outside patrol times in this period will never be known as surf life savers are not officially on duty, however the balance of 28.6% of the cases for which data was available, did occur outside standard patrol hours.

Of the 90 resuscitation cases occurring during patrol hours, 95.2% were successful between the flagged areas, whereas only 62.3% were successful outside the flags (p=0.004). Successful resuscitation rates for immersion cases between the flags was 93.3% compared to 62.7% outside the flags; collapse victims were 100% successfully resuscitated between the flags, with just 42.9% outside the flags.

Distance from clubhouse
More than half of the resuscitations performed took place less than 400m from the clubhouse, with the proportion of successful resuscitation situations versus distance from the Surf Club shown in Table 2. Resuscitation success varied inversely with distance from the club house (p=0.009).

Table 2
Success rates of resuscitation with increasing distance from patrolled areas (n=154)

DISTANCE FROM CLUBHOUSE	< 200m	200-399m	400-799m	800-999m	> 1km
Success rates	(31/39)	(38/51)	(13/22)	(5/13)	(14/29)
Percentage	79.5%	74.5%	59.1%	38.5%	48.3%

Logistic regression analysis of distance against the dichotomous variable for resuscitation outcome (unsuccessful/successful) revealed that the odds of a successful resuscitation was 79% lower for resuscitations taking place 800m or more from the club house (Odds Ratio=0.21; p=0.002) compared to resuscitations which took place within 200m of the club house.

When resuscitation success versus distance from the club house was considered in relation to the reason for resuscitation, success rates decreased as distance from the clubhouse increased for individuals who were immersed or collapsed (Table 3). Although the number of injury cases is small, it would appear that resuscitation success for those injured on the beach or in the surf is independent of the distance from the clubhouse.

Table 3
Success rates of resuscitation with increasing distance from the club house and primary reason for resuscitation (n=142)

DISTANCE FROM CLUBHOUSE	<200m	200-399m	400-799m	800-999m	>1k
Immersion	(19/24) 79.2%	(30/40) 75%	(9/15) 60%	(3/8) 37.5%	(10/19) 52.6%
Collapse	(6/8) 75%	(2/5) 40%	(1/4) 25%	(0/3) 0%	(1/5) 20%
Injured in surf	(4/4) 100%	(4/4) 100%	-	-	(1/1) 100%
Injured on beach	(1/1) 100%	-	-	-	(1/1) 100%

Victim's facial colour
At first assessment, 8 patients had a normal facial colour, 62 were pale, 62 were blue, 31 were grey. One patient was dark skinned and could not be assessed this way, and the facial colour data was missing for the remaining 7 cases. Resuscitation success varied significantly with facial colour (p=0.003). The colour of the victim's face on initial presentation proved to be a reasonably good indicator of survival. Victims whose facial colour appeared to be "normal" or "pale" generally fared better than those who looked "blue" whereas those who looked “grey" did worst of all (FIGURE 2).

When the reason for resuscitation was considered, the colour of the victim’s face on initial presentation appeared to be a reasonable indicator of survival for immersion and collapse incidents (Table 4).

Table 4
Resuscitation success rates by initial facial colour and primary reason for resuscitation (n=142)

INITIAL FACIAL COLOUR	NORMAL	PALE	BLUE	GREY
Immersion	(0/2) 0%	(30/36) 83.3%	(32/45) 71.1%	(9/22) 40.9%
Collapse	(2/2) 100%	(8/15) 53.3%	(5/10) 50%	(0/4) 0%
Injured in surf	(3/3) 100%	(5/5) 100%	(2/2) 100%	-
Injured on beach	-	(1/1) 100%	(1/1) 100%	-

Vomiting
Fifty five percent of victims vomited (active, muscular contraction of abdomen), or regurgitated (silent, and subsequently more dangerous flow of stomach contents into the upper airway). When all cases were considered, resuscitation success was less likely (p=0.004) if the individual vomited or regurgitated - the success rate of those not vomiting being 78% (56/72) compared to 56% (51/91) of those who vomited.

Vomiting was more prevalent amongst immersion victims - 65.4% of immersion victims vomited compared to 40% of those who collapsed. As might be expected, vomiting was uncommon amongst injury cases - only one such individual was reported to vomit. Resuscitation success rates were lower for immersion or collapse patients who vomited, compared to those who did not (Table 5).

Table 5
Reason for resuscitation with success rates for vomiting (or regurgitation)

SUCCESS RATES	NO VOMITING	VOMITING
Immersion	(29/36) 80.6%	(40/68) 58.8%
Collapse	(12/20) 60%	(4/13) 30.8%

Airway problems
Of the 162 reports on any airway difficulty, 40.7% (66/162) experienced a problem. Reasons given for the difficulty were vomit in 48% of these cases, jaw clenching in 13.5%, with no definable reason in the remaining 38.5%.

Face Masks
Face masks were used in just 18 of the total cases . In 17 the resuscitation also involved the use of the mechanical respirator (which contains 2 face masks). On only one occasion was a mask used without the respirator. There appeared to be no increase in use in recent years.

Alcohol
Alcohol was involved in 21% of the 160 resuscitations for which this information was available. Three victims with a smell of alcohol on their breath were under 18 years of age. The majority (88.5%) of incidents involving alcohol were from immersion. The involvement of alcohol did not differ significantly between the sexes (p=0.536).

Alcohol did not appear to reduce the likelihood of a successful resuscitation in this series. Seventy nine percent of resuscitations involving alcohol were successful, whilst only 63.5% of resuscitations not involving alcohol were successful. This difference was not statistically significant (p=0.097) either overall, or within immersion and collapse categories.

DISCUSSION

To the credit of all surf lifesavers who took the time to fill in "yet another form", the quality of response was excellent, with most forms having the majority of important information recorded. These forms (Form 1) have now been used for twenty years. As there are some areas with deficiencies and others where new information would be beneficial, their use has recently been abandoned and the more modern resuscitation forms used by Surf Life Saving Australia have been adopted (Form 2), making such data collection nationally uniform and able to interface with such programmes as the Australian Beach Protection Survey.

There are two very significant statistics for the SLSA. Firstly, the notable percentage (95.2%) of people successfully resuscitated by qualified and proficient surf lifesavers during patrol times and between the flags - - the area chosen by patrolling surf lifesavers as the safest to swim, and delineated by standard red and yellow flags. It compares with just a 62.3% success outside the flags, but still during patrol hours. Secondly, the highly significant data on resuscitation success diminishing statistically with increasing distance from the club house (which is usually close to the patrolled areas). These statistics support the SLSA aim to educate the bathing public to "bathe between the flags".

The anomaly with resuscitation cases greater than 1 kilometre from the surf clubs having a better success than expected is likely a natural selection group that had remained stable prior to resuscitation help arriving some time after the initial event due to distance involved.

Accepting the small numbers in this series, resuscitation seems to be more effective in certain age groups. The poor success rate in the ages 35 - 64 years, particularly in males, is unexplained, but may be due to a higher prevalence of myocardial infarction whilst swimming, thus leading to immersion, or collapse.

Further interesting data indicates that the victim's facial colour on first presentation correlates closely with the outcome of resuscitation success. This clinical observation by resuscitators should be encouraged.

Vomiting and regurgitation often occurs during resuscitation, particularly in the immersed victim. In this study immersed victims were more likely to vomit and any victim vomiting was less likely to survive a resuscitation attempt. This emphasises the need to closely monitor victims who are being resuscitated, ensuring that should vomiting occur, the airway is once again completely cleared in the usual manner before proceeding further with the resuscitation.

Airway problems are often experienced, and the method of jaw support using a `pistol grip' on the mandible (thus lifting the tongue which is attached to the mandible and so helping open the airway) may be difficult with some people, and even more difficult if there is saliva or vomit on the chin, making grip very difficult. In these cases jaw thrust may be a better method of airway control, especially when a mask is used (which will also be beneficial to the resuscitator). A cuffed endotracheal tube is the best method to totally protect the airway but is only possible if a suitably-qualified doctor is present at the time, with the correct equipment. Many St John Ambulance personnel are now taught how to insert Guedel airways to help keep the airway open. Perhaps there is also the need to also teach surf lifesavers this technique?

Following the heightened community awareness of the risks of transmission of Hepatitis B and the publicity surrounding A.I.D.S. in the late 80's, lifesavers were encouraged to use face masks for expired air resuscitation. There appeared to be no increase in their use in the years covered by this study despite these measures. However, masks are usually stored in the mechanical respirators and may not have been quickly accessible. Since 1990 surf lifesavers on patrol in Queensland carry personal patrol "bum-packs" which contain, amongst other items, a collapsible face mask and disposable latex gloves. This will hopefully increase the use of masks for resuscitation cases for the future, thus minimising the risks of spread of communicable diseases.

Alcohol was reported as being `smelt on the breath' in one fifth of the cases. This crude method of assessment probably means that alcohol intake in those needing rescue and resuscitation was much more common, a finding probably similar to that found in road traffic and industrial accidents.

CONCLUSIONS

The value of voluntary surf lifesaving community service is difficult to assess. Even the most modest assessed value of a human life has been calculated at $625,000.[4] The monetary value alone of lives saved by Queensland surf lifesavers during the period of this study would thus be millions of dollars.

The best way to decrease the numbers of resuscitation cases is to prevent or reduce the need for rescue. This is difficult to achieve, due to the Surf Life Saving Association's limited resources to cope with the dramatically increasing numbers of visitors and bathers in the past few years in Queensland - 14.23 million in 1991 alone (National Centre for Studies in Travel and Tourism). Surf Life Saving currently uses a number of methods to help reduce the number of rescues including fixed-wing aircraft, helicopters, inshore rescue boats (IRB's) and jet rescue boats (JRB's) to patrol areas where people may be bathing in dangerous situations. Such patrol and rescue systems are expensive, and only partially funded by Governments. Surf Life Saving Australia relies heavily on public subscription and corporate funding. Although many suggestions are being considered, they need more manpower and more money to implement.

Funding by Governments, local authorities and sponsors is essential if a voluntary organisation such as Surf Life Saving Australia is to continue. More money is needed to increase such services. Surf lifesavers achieve and maintain an expertise in resuscitation that is continually, and necessarily, updated. Maintenance of fitness to perform rescues is imperative. Competition is seen as a way of facilitating this fitness, and at the same time gives a greater public image and helps recruitment for Australia's volunteer Surf Life Saving Association.

The old maxim "prevention is better than cure" requires continual promotion. The public must become more aware of the dangers of swimming unaccompanied, of alcohol and swimming, and of the need to "bathe between the flags" - the red and yellow halved beach flags denoting the area patrolled by dedicated volunteer surf lifesavers who are experts in rescue and resuscitation and have a good knowledge of first aid (including the treatment of marine stings).

Accidents and collapses that occur away from the patrolled beach carry an expected risk, and will continue; surf lifesavers will still be called upon because of the Australian public's awareness of their expertise with practical resuscitation skills. In an age dominated by more and more complex medical and para-medical equipment, nothing has replaced simple barehanded resuscitation when, and where it counts - immediately at the scene of the accident.

ACKNOWLEDGMENTS

We would like to thank Mick Blair, Paul Fenner and Margaret Fenner for the many hours entering the information into the database, and Andrew Buhk for his assistance with some of the data used.

REFERENCES

[1] Stata Corporation. Intercooled Stata release 3.1. College Station, Texas 1993.
[2] Pagano M, Gauvreau K. (Eds) Principles of Biostatistics. Belmont, CA: Duxbury Press.
[3] Hosmer DW Jnr, Lemeshow S. Applied Logistic Regression. New York: John Wiley & Sons 1989:216-238.
[4] Andreassen DC. Preliminary costs for accident types. Report ARR 217, Australian Research Board, Melbourne, 1992:15.