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Toddler Drowning Prevention: Teaching Parents About Child CPR in Conjunction With Their Child's In-Water Lessons

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ORIGINAL RESEARCH

Toddler Drowning Prevention: Teaching Parents About Child CPR in Conjunction With Their Child's In-Water Lessons

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The purpose of the study was to develop a program that addressed parental misconceptions of child CPR. Parents ($n = 109$) of toddlers enrolled in swim school lessons were randomly assigned to control, pool-based instruction and home-based groups. Initially, one third (30%) of parents were confident of their ability to perform child CPR and only one fifth (22%) correctly reported the recommended compression-to-rescue breath ratio of 30:2 for child CPR. Postintervention, confidence and knowledge of CPR protocols improved significantly for both instruction groups compared with the control group. Correct compression-to-breath ratios significantly improved for the pool-based group (86%) and home-based group (87%) compared with the control group (33%). Child CPR instruction at swim schools provided a valuable opportunity to reduce parental anxiety about performing child CPR and improved knowledge of child CPR. Further research is required to determine how other toddler parents might similarly benefit from such a program.

Many organizations currently promote a multifaceted "layers of protection" approach to child drowning prevention (notably the World Health Organization [WHO], 2008; American Academy of Pediatrics [AAP], 2010; International Task Force on Open Water Drowning Prevention, 2009). Chief among the layers of protection promoted have been early learn-to-swim interventions, close and constant caregiver supervision of children around water, and parental knowledge of CPR. Even though the circumstances surrounding toddler drowning are well reported, little is known about how well prepared parents are in preventing such tragedies from occurring by the application of cardiopulmonary resuscitation (CPR). Because parents are often the first responder at the scene of a toddler drowning emergency, parent knowledge of CPR has been advocated as a critical first response in the chain of drowning prevention (WHO, 2008). Such advocacy is based on several studies reporting favorable outcomes as a result of bystander resuscitation (Eich et al., 2007; Goh & Low, 1999; Kyriacou, Arcinue, Peek, & Kraus, 1994: Marchant et al., 2008; Pepe, Wigginton, Mann, Persse, Sirbaugh, & Berg, 2002; Venema, Groothoff, & Bierens, 2010; Youn, Choi, Yim, & Park, 2009). One study suggested parents who witness the cardio-pulmonary arrest of their own child performed CPR

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at low frequencies (Sirbaugh et al., 1999), leading to claims that not enough people know how to perform CPR (Wigginton, Pepe, Mann, Persse, & Sirbaugh, 2006).

A previous study by Moran and Stanley (2011) found that many parents had limited understanding of child CPR protocols, less than one-fifth (19%) of the 1,716 participants from swimming schools and early childhood centers identified the correct compression-to-breath ratio (30:2), and most parents (62%) felt anxious about their ability to perform child CPR. Findings such as these highlighted the need for education interventions to address the substantial gaps in knowledge of CPR for parents of young children.

Determining how best to provide parents of young children with the opportunity to enhance their understanding of CPR remains a challenge for drowning prevention advocates. When asked what avenues may be best used to facilitate improved parental knowledge of CPR, Moran and Stanley (2011) found that most parents (n = 1,716) surveyed at swim schools and early childhood centers agreed/strongly agreed with training access at high schools (88%), early childhood centers (87%), and swim schools (73%). Fewer supported CPR training via their health professionals (58%) or via online computer programs (48%). A recently-reported Australian study on swim school instructor beliefs on toddler water safety education suggested that almost all (97%) of the 133 respondents considered themselves capable of performing child CPR, although this study did not explore instructors capacity to teach CPR or the recency of their training (Blitvich, Moran, Petrass, McElroy, & Stanley, 2012). In light of this background and perceived needs, it was the purpose of the current study to devise and evaluate a pilot parent education program aimed at enhancing the CPR knowledge and confidence of parents while their young children were enrolled in lessons in commercial swim schools.

A previous attempt by the authors to include information on child CPR in a swim school program of parent water safety training conducted on the poolside (while their children were receiving instruction in the water) had not been effective (Moran & Stanley, 2006b). While other aspects of parental knowledge of child water safety identified in a previous study (Moran & Stanley, 2006a), such as the need for close and constant supervision around water, had improved, knowledge of child CPR procedures did not improve significantly as a consequence of the follow-up intervention. Many of the 106 parents who took part in this study failed before and after instruction to recall the correct compression-to-breath ratio (pre-74%, post- 65%). A likely explanation for the lack of improvement was that the intervention relied primarily on the distribution of written resources followed by the opportunity for informal discussion when, and if, required; it did not include practice on a manikin.

Other studies have indicated that CPR may best be taught using self-directed learning using self-instructional video, practice manikins, and interactive computer training rather than the traditional didactic instructor-led practice (Batcheller, Brennan, Braslow, Urritia, & Kaye, 2000; Done & Parr, 2002; Isbye, Rasmussen, Lippert, Rudolph, & Ringsted, 2006; Lynch, Einspruch, Nichol, Becker, Aufderheide, & Idris, 2005; Monsieurs et al., 2004; Reder, Cummings, & Quan, 2006). A study comparing traditional (instructor-led), case-based (using CPR scenarios and a role playing format), and web-based instructional methods among 90 university students reported poorer performance as a result of web-based instruction that used video self-instruction as a learning tool (Sarac & Ok, 2010). It was decided that the

study should include instructor-led and self-directed learning methods (each using infant manikins) because both methods may be appropriate in a learning environment such as a swim school and with a population of parents motivated enough to pay for swimming lessons as a protection against child drowning.

Method

The study design was a cluster-controlled trial among parents whose preschool children (under 5 years) were enrolled in lessons at four Auckland swim centers, two commercial swim schools, and two municipal (local council operated) pools during the summer school holidays. The project was approved by the University of Auckland Human Participants Ethics Committee on 11th February 2009 (Reference Number 2009/Q/001).

Participants

Parents who agreed to take part in the study were randomly allocated to one of three groups: a control group that received no CPR instruction, a pool-based CPR instructor-led group, and a home-based CPR self-instruction group.

Research Instrument

All parents completed a written questionnaire on child CPR during their child's first in-water lesson. The questionnaire contained eight closed questions that included demographic information on gender, ethnicity, and length of residency in New Zealand. Parents were asked whether they had ever received CPR training and, if so, when had they last received formal training in CPR. They were then asked how they felt about performing infant/toddler CPR using a four point scale of *very confident*, *confident*, *anxious,* or *very anxious*. One multiple-choice question with four possible responses focused on the compression-to-breath ratio. Two five-part questions focused on current child CPR protocols using true or false responses. At the end of the toddler's five lessons, all parents were again asked to complete the questionnaire and data from the pre- and postintervention responses were compared.

CPR Instruction Procedures

Parents in the pool-based group were taught by a trained CPR instructor who was not part of the swim school staff, using manikins and current instructional posters, while their child was receiving swimming instruction in the pool. The CPR instruction took place during a 20–25 min session that allowed sufficient time to settle their toddlers into their water-based lessons and collect them at the end. Each parent was taught on pool deck in close proximity to their child to minimize possible distress among the children in the pool. During this session, the parents were shown a detailed step-by-step demonstration of toddler CPR that illustrated correct basic life support responses and protocols related to a child drowning episode using manikins. This was then followed by a faster, more fluid demonstration showing appropriate response time and speed on the same manikin. Each parent was then encouraged to attempt CPR on the manikin themselves and was provided

with feedback on their performance by the instructor. The posters were used as a visual aid to provide reminders of the sequence of CPR protocols. Parents were encouraged to practice with and without this additional aid to see if they could recall all the key information required to complete successful CPR simulation. Time was allowed for the pool-side parents to seek advice from the instructor on CPR protocols and their application in both drowning and nondrowning related scenarios where resuscitation was required.

Parents in the self-taught group were provided with a "Mini Baby Infant" kit sourced from Laerdal New Zealand. Each kit contained a Mini Baby CPR learning manikin, CPR skills practice DVD, fold out quick reference skills reminder, practice phone, manikin wipes, and Mini Baby spare lungs. With this self-directed learning program, parents were able to take their kits home to practice and share with other family members. Parents were encouraged to watch the CPR Skills Practice DVD several times and to practice regularly with the manikin in the 2 weeks that they had the take home kits. Parents in this group returned their manikins on the last day of lessons at completion of the posttest.

The control group received no instruction or information, but completed the pre- and posttest questionnaire at the beginning and end of their child's five lessons with the parents allocated to the two intervention groups. Upon completion of the postintervention questionnaire, all parents were provided with a complimentary brochure on child CPR for their future reference.

Data Analysis

Data from the pre and posttest surveys were downloaded into SPSS Version 19 for statistical analysis. Descriptive statistics were used to characterize all numerical variables using frequency and percentages. Four independent variables (sex, ethnicity, length of residency, and CPR training) and three dependent variables (anxiety/confidence about performing child CPR, knowledge of correct compression-to-breath ratios, and knowledge of CPR protocols) were reported using frequencies and percentages. Results from the CPR knowledge pre- and postsurveys were chi-square tested to determine whether the interventions significantly improved parents understanding of child CPR when compared with the noninstruction control group.

Results

Of the 143 parents invited to participate in the study, a sample of 109 completed both the pre- and postintervention survey, representing a 76% response rate. Of these, 86% were female, 73% were long-term residents (> 10 years), and 65% of the sample self-identified their ethnic origin as European, 11% as Maori, 11% as Asian, 5% as Pacific Islanders, and 8% as being from other ethnic groups. Two-thirds (66%) of parents (n = 72) reported having had previous CPR training, and of these, half (54%) had received their instruction within the last five years (n = 39). The initial survey responses from the three groups were compared so as to determine whether the random allocation to groups had been effective. Chi-square testing found no significant differences with regard to group demographics (gender, ethnicity, length of residency), prior CPR training, confidence to perform child CPR, or knowledge of child CPR protocols.

Table 1 shows that initially, less than one third (30%) of parents were confident of their ability to perform child CPR. Upon completion of CPR instruction, all groups reported increased confidence in their ability to perform child CPR but the increase was significantly greater for the pool-based ($\chi^2 = 9.529$, $df = 3$, $p = .008$) and home-based ($\chi^2 = 16.170$, $df = 3$, $p = .001$) instruction groups compared with the control group. No significant difference in levels of confidence was found between the pool-based and home-based instruction groups.

Table 2 shows that in the preintervention analysis, almost half (43%) of all parents incorrectly reported a compression to breath ratio of 15:2, and only one fifth (22%) correctly reported the most recently recommended ratio of 30:2 (New Zealand Resuscitation Council, 2010). In the postintervention analysis, the proportion of correct responses had improved significantly for parents in the pool-based group ($\chi^2 = 21.395$, $df = 3$, $p = < 0.001$) and home-based group ($\chi^2 = 22.643$, $df = 3$, $p = < 0.001$), but not the control group. No significant difference was found between the pool-based and home-based groups in the reporting of the correct compression to breath ratio.

Parent responses to the true/false statements in the initial questionnaire indicated that upon entering the study, many had major misconceptions about child CPR. Almost two thirds (63%) incorrectly thought an initial 5-s pulse check was required. More than half incorrectly thought CPR should be continued for 5 min before stopping (54%), and the lungs should be cleared before commencing CPR (51%). Most parents correctly responded to statements relating to giving five initial breaths before commencing compressions (81%), use of mouth to mouth-and-nose for infant CPR (89%), and pinching of the nose during toddler rescue breathing (85%).

Table 3 shows that some significant changes in understanding of CPR protocols were evident postintervention for the combined pool-based and home-based instruction groups compared with the control group. Significantly, more parents from both intervention groups correctly responded to statements related to stopping CPR after 5 min, to performing CPR at a ratio of 15:1, to using five initial breaths,

Table 1 Parent Confidence in Their Ability to Do Child CPR

	Control Group *n* (%)	Pool-Based Instruction *n* (%)	Home-Based Instruction *n* (%)	Total *n* (%)
Confident				
Pre	11 (31%)	9 (25%)	8 (21%)	33 (30%)
Post	15 (42%)	24 (67%)	32 (86%)	73 (67%)
Anxious				
Pre	25 (69%)	27 (75%)	29 (79%)	76 (70%)
Post	21 (58%)	12 (33%)	5 (14%)	36 (33%)
Group totals	36	36	37	109 100%)

Table 2 Compression-to-Breath Ratios Pre and Postintervention

	Control Group *n* (%)	Pool-Based Instructor *n* (%)	Home-Based Instruction *n* (%)	Total *n* (%)
30:2				
Pre	8 (22%)	7 (19%)	7 (19%)	22 (20%)
Post	12 (33%)	31 (86%)	32 (87%)	75 (69%)
15:2				
Pre	16 (44%)	15 (42%)	16 (43%)	47 (43%)
Post	17 (50%)	4 (14%)	2 (7%)	24 (22%)
10:1				
Pre	8 (22%)	6 (17%)	7 (19%)	21 (19%)
Post	3 (8%)	1 (3%)	2 (5%)	6 (6%)
Other				
Pre	4 (11%)	8 (22%)	7 (19%)	19 (17%)
Post	4 (11%)	0	0	4 (4%)
Group totals	36	37	36	109 (100%)

to placing two fingers on a toddler's chest during compressions, to clearing the lungs before commencing CPR, and to checking the pulse for 5 s before starting CPR. No significant differences were found in these six responses between the two intervention groups. When all 10 correct responses were summed and compared postintervention, both the pool-based ($\chi^2 = 29.448$, $df = 9$, $p = .001$) and home-based ($\chi^2 = 36.021$, $df = 9$, $p = < 0.001$) groups had significantly more accurate recall of CPR knowledge than the control group. No significant differences were found between the intervention groups and the control group with regards to seeking help after one minute; compression depths; the use of mouth to mouth/nose with infants, and pinching of the nose during rescue breaths for young children.

Discussion

This study showed that an informal parent education program, run in conjunction with toddler swim school lessons, significantly improved parental understanding of child CPR for parents who undertook pool- and home-based instruction. This was evident in three key areas: (a) more accurate recall of current CPR chest compression-to-rescue breath ratios, (b) better understanding of critical changes in current CPR protocols, and (c) greater confidence in their ability to perform child CPR. On the basis of these significant improvements and in keeping with the notion of the need for multiple layers of protection to prevent child drowning, it is recommended that swim schools include parent CPR instruction as an adjunct to their toddler swimming lessons. Enthusiasm for its inclusion should be tempered with several pragmatic considerations.

Table 3 Parents Who Correctly Responded to Child CPR Statements Pre and Postintervention

	Control Group *n* (%)	Pool-Based Instructor *n* (%)	Home-based Instructor *n* (%)	χ^2/p
Stop after 5 min				
Pre	10 (28%)	6 (17%)	7 (19%)	16.053
Post	8 (22%)	20 (56%)	25 (68%)	< 0.001*
Go for help after 1 min				
Pre	5 (17%)	18 (62%)	24 (65%)	1.992
Post	22 (61%)	26 (72%)	28 (76%)	0.369
Perform 15:1 ratio				
Pre	15 (42%)	13 (36%)	13 (35%)	21.809
Post	15 (42%)	31 (86%)	31 (84%)	< 0.001*
Press down ½ chest depth				
Pre	15 (42%)	9 (25%)	6 (16%)	3.999
Post	16 (44%)	21 (58%)	13 (35%)	0.135
Use mouth/nose with infants				
Pre	32 (89%)	29 (81%)	27 (73%)	0.569
Post	31 (86%)	33 (92%)	33 (89%)	0.752
Give 5 initial breaths				
Pre	26 (72%)	29(81%)	31 (84%)	6.857
Post	25 (69%)	31 (86%)	34 (92%)	0.032*
Two fingers on toddlers' chest				
Pre	10 (28%)	19 (53%)	10 (27%)	22.835
Post	10 (28%)	28 (78%)	27 (73%)	< 0.001*
Clear lungs before starting				
Pre	13 (36%)	17 (47%)	13 (35%)	14.004
Post	9 (25%)	20 (56%)	25 (68%)	0.001*
Check pulse for 5 s				
Pre	4 (11%)	5 (14%)	9 (24%)	13.613
Post	5 (14%)	16 (44%)	20 (54%)	0.001*
Pinch nose in rescue breaths				
Pre	26 (72%)	21 (58%)	24 (65%)	1.027
Post	29 (81%)	32 (89%)	31 (81%)	0.598

First, coordinating the inclusion of CPR education for parents proved logistically difficult in a commercial space with competing demands on parents' time and energy (taking part/observing their child swim lessons, undertaking CPR training at home in parents' own time, organizing distribution and collection of teaching aids). Second, whether swim school staff and instructors are sufficiently and currently qualified to teach parent child CPR is an important consideration for schools wishing to offer CPR instruction to parents. Blitvich and colleagues (2012) reported that while most instructors (97%) considered that they were capable of performing CPR on a young child, less than half (47%) correctly recalled the meaning of the acronym A-B-C (Airway-Breathing-Circulation), which at the time of the study, was used in CPR instruction. Only three-quarters (78%) correctly recalled the chest compression-to-breath ratio of 30:2. The current study used well qualified instructors who were not members of the swim school staff; successful implementation in the future may require "up-skilling" of swim school staff or collaboration with external organizations to provide suitably expert poolside instruction.

The study explored two pedagogical approaches to teaching adults: that of traditional instructor-led training at the pool and home-based self-instruction using a range of learning resources, both of which resulted in significant improvement in parent knowledge. However, given that the availability of qualified instructors at swim schools (or any other early childhood venues) is likely to be a limiting factor, it may be that the self-instruction method would be the more cost effective method as has already been reported in other studies (Batcheller et al., 2000; Done & Parr, 2002; Isbye et al., 2006; Lynch et al., 2005; Monsieurs et al., 2004; Reder et al., 2006). While this may be so, self-instruction is not without its own problems. The initial cost of take-home kits and the logistics of resource dispatch are pragmatic considerations for those swim schools wishing to promote child CPR in the way presented in this study.

Limitations

Results from this study should be interpreted with some caution in light of several methodological limitations. First, because the survey was conducted at swim schools, most (86%) of the respondents were mothers; fathers are under-represented. Even though mothers are usually the primary caregiver of young children, fathers too often act in supervisory roles of young children in and around water. Second, the selection of two commercial swim schools as a study location may have biased the sample toward those able to afford commercial swim lessons. Further study on the provision of child CPR for caregivers for whom cost is a limiting factor is needed. Third, the study measured and reported only on recall of knowledge, not practical application of CPR skills. Future research using manikin-related practical tests ought to address this limitation. Fourth, the study only reported immediate postintervention changes in parental understanding of child CPR; further study is required to determine the longer term nature of the changes over months or years.

Conclusions

While further study is required to determine the long-term effects of this pilot intervention, these results do indicate the strong potential to positively influence parental understanding of child CPR through institutions such as swim schools.

Commercial swim school operators need to consider the added value that such instruction might provide in building appropriate layers of protection to reduce or prevent drowning for the very young around water in relation to the additional costs that CPR instruction might incur. Whether parents would be prepared to shoulder the costs of such an intervention requires further investigation. In addition, collaboration between swim schools and organizations that currently promote CPR instruction might help offset instruction costs. Similar interventions through other venues (such as at daycare, play centers, or kindergartens) may further improve parental understanding of child CPR. More work is needed to ascertain the economic and administrative feasibility of providing either instructor-led or self-taught home kits for parents to learn child CPR in other early childhood environments. These concerns notwithstanding, this study suggests that all early childhood parent education programs would benefit from the inclusion of child CPR instruction and should be encouraged in the broader interests of child drowning prevention.

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