Evaluation of a brief intervention designed to increase CPR training among pregnant pool owners

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Abstract
This study evaluated whether a brief videotape could motivate pregnant pool owners to be trained in infant/child cardiopulmonary resuscitation (CPR). Women were recruited from prenatal classes in South Florida. Eligible volunteers were randomized to view a video or receive standard treatment, after completing a questionnaire. The video explained toddler drowning risk, as well as the value of isolation pool fencing and CPR training. Women were contacted by phone 6 months after giving birth to complete a follow-up survey. Sixty-one percent of eligible mothers agreed to study enrollment and 92% of those completed a follow-up interview (n = 101). At baseline, there was no significant difference between the proportion of mothers with current CPR training in the treatment and control groups. At follow-up, 48% of those in the intervention group reported CPR instruction versus 28% of the control group ($\chi^2 = 3.93, P = 0.03$). Video viewers were also more likely to report significant changes in perceptions that favored CPR training. Health care facilities located in communities with high rates of toddler drowning may want to screen prenatal students for pool ownership and encourage at-risk families to be trained in infant/child CPR. Such programs should, however, emphasize the primacy of isolation fencing as a preventive measure.

Introduction
In warm weather states like Florida and Georgia, drowning is the leading cause of death for children aged 1 through 4. Most of these deaths occur in residential swimming pools [1, 2]. In fact, 75% of all of the people who drown in swimming pools are less than 5 years of age [2]. While supervision may be the first line of defense against such pediatric injuries, these data demonstrate that it represents a flawed stand-alone strategy. The primary prevention method that has received convincing empirical support is fencing that completely surrounds a backyard pool so there is a physical barrier between the house and drowning hazard. So-called ‘isolation fencing’ has been shown to reduce mortality risk by 83% [3]. Unfortunately, no US state has passed a model law that requires homeowners to adopt this effective countermeasure.

A secondary means of reducing the likelihood that a submersion will result in a fatal outcome is by initiating cardiopulmonary resuscitation (CPR) as soon as a child is pulled from the water. The mechanism of death in fatal drowning is almost always a cardiac arrest, brought on by asphyxia [4]. It has been estimated that an additional 30% of pediatric drowning victims would survive—usually with good neurological function—if a trained resuscitator had been on the scene at Time Zero [5]. A case–control study conducted in California demonstrated that children who had experienced life threatening submersion events were five times more likely to have
a good clinical outcome if resuscitative efforts were initiated immediately (i.e. versus delayed until the arrival of paramedics) [6]. One series of children brought in over a 30-month period reported no survivors among children whose CPR was initiated more than 10 min after their drowning-related cardiac arrests [7]. The authors of an 11-year study of emergency medical services system responses in Houston concluded that performance of CPR by bystanders, ‘appears to be the necessary factor … determining intact survival in pediatric drowning victims’, without which ‘subsequent advanced and invasive life support techniques appear to be of little value’ [8].

Unfortunately, the proportion of pediatric victims who receive bystander CPR is estimated to be 30% [4]. In light of such evidence, the Centers for Disease Control and Prevention, the American Medical Association and the American Academy of Pediatrics (AAP) have all recommended that parents with pools be trained in infant/child CPR. Guidelines developed by the International Open Water Drowning Prevention Taskforce also encourage CPR training [9]. Finally, the AAP also recommends parental CPR training as a choking prevention countermeasure [10].

While there is evidence that pool owners are favorably disposed to CPR instruction, and there have been calls for a trial targeting this population [11], we could find no published reports of such an intervention. Our study was designed to evaluate whether pregnant women who owned residential swimming pools could be persuaded to install isolation fencing around their pools and take infant/child CPR before their babies reached 6 months of age. We choose this target date because a child’s risk of drowning rises dramatically once they become mobile [12]. Our fencing outcomes will be reported elsewhere.

The videotape and survey instrument that we produced for this study were influenced by the Health Belief Model (HBM). According to the HBM, people are most likely to follow a preventive recommendation (e.g. install isolation fencing, take infant/child CPR) if they believe that they are susceptible to the health problem, believe that the health problem could have severe consequences and believe that the benefits of following the recommendation outweigh the costs. If a person is cognitively ‘ready’ to take action by this set of criteria, the HBM posits that they are more likely to do so if they feel capable of carrying out the recommendation and are prompted by a ‘cue to action’ [13].

Our video included some scenes that might be frightening to study participants because fear appeals have been shown to increase positive attitude and behavior changes when they are combined with convincing messages about the recommendation’s efficacy (e.g. the effectiveness of bystander CPR) [14]. We developed two versions of our intervention video because we wanted to test whether the inclusion of a mother recounting her personal story of losing a child to drowning would enhance the intervention’s effectiveness, by increasing the audience’s perceived susceptibility. In a study that compared a didactic video encouraging mammography to one that utilized cancer survivor narratives, women assigned to the latter were more likely to identify with the message source [15].

**Methods**

**Study design**

This evaluation utilized a randomized control trial design. Women were randomized (by prenatal class) to one of two treatment groups or standard care (no drowning prevention video). Parental beliefs and behaviors were measured by a survey instrument that was self-administered at baseline and investigator administered (by phone) at follow-up.

**Setting**

This study was conducted in Florida because that state has the highest toddler drowning rate in the country, at almost three times the national average (Centers for Disease Control and Prevention, 2007 data). We recruited women from prenatal classes being offered in Miami-Dade and Broward counties because those counties had the highest number of
drownings in Florida. This study was carried out from November 2005 to November 2008. It was approved by the Institutional Review Boards of the author’s University and all participating hospitals.

Selection of participants
At the beginning of prenatal courses offered at our four collaborating hospitals, students completed an anonymous screening form that asked if they had ‘an in-the-ground pool’ in their backyard (i.e. ‘We mean a family pool, not one that is shared by the whole community or complex’). Respondents were also asked whether they expected to attend the last class and to be living in the Miami area when their child reached 6 months of age. Women under the age of 18, and those who could not speak English, were not eligible for study inclusion. This screening process allowed instructors to know whether any potential trial participants were enrolled in the class. If there were, those women were invited to stay after class at the end of the last session to learn more about this research opportunity. Women who stayed took part in an informed consent process and then volunteered or declined the instructor’s offer of participation. This decision, and completion of the baseline survey, took place before the students or the instructor knew if that ‘group’ (i.e. two mothers on average per class) had been randomized to video viewing or control group status. Our study participants were drawn from 58 prenatal classes.

Intervention
Once volunteers completed their baseline questionnaires, the prenatal instructor removed ‘correction tape’ that had previously concealed that class’ assignment to one of two video versions or control group status. Group assignments had been made in advance, using random numbers, by the principal investigator off-site. Control group members simply went home at that point. Intervention group members watched a 7 or 9 min videotape that had been developed for this study. Both versions portrayed a pregnant couple who were preparing their home for the arrival of their new baby. The videos explained that in that ‘part of the country’, pool drowning was the leading cause of death for toddlers. Frightening footage (e.g. an unresponsive child being pulled out of a pool) was included. The tapes described the advantages of installing isolation fencing and of taking infant child CPR. The latter was justified in light of the circumstances involving most toddler drownings, and the speed with which resuscitation efforts need be started after a serious submersion event. The need for current training was also explained. The longer version of the tape also included a 2-min segment of a mother recounting the circumstances of her son’s actual drowning. We wanted to see if this element added to the intervention’s effectiveness, by increasing viewers’ risk perceptions. We hoped that women would identify with the bereaved mother, who says at one point ‘We thought it would never happen to us … that it only happens to people that [sic] don’t watch their children. That is not true. This happens to good parents’.

Methods of measurement
Our survey instrument was also developed for this study. It took approximately 10 min to complete and contained mostly Likert-type items that measured drowning risk perceptions, as well as attitudes toward pool fencing and CPR training. Most of our questions were intended to assess Health Belief Model constructs. Their exact wording appears in Table II.

Data collection and processing
Prenatal class instructors mailed completed surveys and consent materials to the principal investigator’s university, which is where data entry and analysis took place. When a subject’s child reached 6 months of age, the mother was contacted by telephone for the purpose of completing a follow-up questionnaire. Interviewers were blinded as to the subject’s group assignment.

(Note that control group members were given the opportunity to receive written drowning prevention information [16, 17] once data collection was completed.)
Outcome measures

Early in our questionnaire, women were asked, ‘Have you ever taken an infant/child CPR class?’ Positive respondents were then asked, ‘When were you last trained?’ This detail was included because parental CPR skills have been shown to ‘decay’ rapidly [18–20].

Study participants who reported having taken a class less than 1 year ago (or had already registered for an upcoming class) were counted as being CPR compliant. We chose this definition because our goal was to afford the children born to these study participants an adequate level of protection (i.e. having a mother with current CPR skills) by the time they entered the window of risk for toddler drowning.

Respondents judged to be compliant at follow-up were asked, ‘Where did you take the class?’ With the exception of women who reported having been trained through their employer, we contacted the organization in question to ensure that they did ‘offer’ infant/child CPR training (i.e. not to inquire whether the mother in question had been trained).

Data analyses

Data were entered into an SPSS database. Participants were categorized, both at baseline and follow-up, as being CPR compliant or non-compliant. Chi square statistics were used to compare CPR training status proportions for our three treatment groups. Since the outcomes for both treatment groups appeared to be comparable at follow-up, and we were dealing with unexpectedly small sample sizes, we decided to combine mothers who saw either version of the video for our final analysis. A check on the outcome of our randomization procedures was conducted using chi square statistics—or Fisher exact tests when cell sizes were inadequate—to compare our intervention and control groups’ baseline characteristics. Mean pre- to post-intervention changes in responses to our attitude items were computed and compared for the video and non-video group, using paired samples t-tests. The Likert scale ratings compared for those analyses ranged from 1 (strongly agree) to 5 (strongly disagree). To determine whether women who had been exposed to our intervention were more likely to report that they had been trained in infant/child CPR, we used Survey Procedures in Stata (Version 10). Those procedures estimate and apply a design effect that would account for any intracluster correlations that might have been introduced by the fact that our volunteers were randomized by class.

Results

Characteristics of study participants

Figure 1 displays our sample disposition. Twenty-one percent of women (n = 181) taking prenatal classes at our recruitment sites were eligible for study inclusion. The primary (99%) reason that women were not eligible for trial inclusion is that they did not have a private pool at their residence. Sixty-one percent of eligible respondents (n = 110) agreed to take part in our trial, and 92% of volunteers (n = 101) completed a follow-up interview. Table I describes our initial 110 participants (i.e. including the nine who were later lost to follow-up) and the characteristics of our intervention and control groups. No significant (alpha = 0.05 level) differences in demographics were observed between our treatment groups. Our study volunteers were primarily first-time mothers, in their third trimester of pregnancy. Their ages ranged from 18 to 47. Not surprisingly, in light of their pool ownership status, most of our participants were from relatively high-income households.

At baseline, 39% of participants reported having been trained in infant/child CPR, but 61% of those women had been trained ≥ 1 year ago. An additional three women were scheduled to take an upcoming class. By our definition, this meant that 16% of respondents were CPR compliant at baseline. The proportions of trained respondents in our control (15%) and video (16%) groups were not significantly different (x^2 = 0.05, P = 0.82).

Main results

At follow-up, 28% (n = 9) of our control group members and 48% (n = 33) of those in our intervention group reported having been trained in infant/child CPR within a year of their babies having reached...
6 months of age. This difference in proportions was significant ($x^2 = 3.93, P = 0.03$). Table II displays mean group beliefs at baseline and mean differences in each group’s beliefs between Time 1 and Time 2 (i.e. baseline and follow-up survey completion). This may be thought of as our evaluation of intermediate
outcomes (i.e. Did we change beliefs thought to motivate CPR compliance?). No significant pre- to post-differences in mean belief ratings were observed for the control group. The intervention group’s beliefs changed significantly from baseline to follow-up for three items designed to measure perceived susceptibility, one designed to measure perceived severity and two designed to measure perceived benefits. In all but one instance, these changes were in the desired direction.

### Table II. Mean within-group changes in beliefs from baseline to follow-up: by treatment group

<table>
<thead>
<tr>
<th>Item (1 = Strongly agree to 5 = Strongly disagree)</th>
<th>Video group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group mean at baseline</td>
<td>Group mean change ($T_1 - T_2$)</td>
</tr>
<tr>
<td>Perceived susceptibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘I worry that my child could drown’</td>
<td>1.86</td>
<td>0</td>
</tr>
<tr>
<td>‘Most toddlers who drown in Florida drown in the ocean’</td>
<td>4.53</td>
<td>$-0.18^*$</td>
</tr>
<tr>
<td>‘Parents who watch their children carefully don’t need to take other drowning prevention precautions’</td>
<td>4.59</td>
<td>$-0.23$</td>
</tr>
<tr>
<td>‘When young children fall into a pool, they usually splash or yell’</td>
<td>3.72</td>
<td>$-0.38^*$</td>
</tr>
<tr>
<td>‘As long as a child is rescued after being underwater for 15 minutes or less, there is a good chance that he will be okay’</td>
<td>4.45</td>
<td>0.03</td>
</tr>
<tr>
<td>‘Car accidents are the leading cause of death for toddlers in Florida’</td>
<td>3.80</td>
<td>$-0.57^{**}$</td>
</tr>
<tr>
<td>Perceived severity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Some children who survive near-drownings [sic] spend the rest of their lives in nursing homes’</td>
<td>3.31</td>
<td>$0.51^{**}$</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Parents who have pools should learn how to do infant/child CPR’</td>
<td>1.04</td>
<td>$-0.09$</td>
</tr>
<tr>
<td>‘If I knew how to do CPR, I would feel like I could save my baby’s life’</td>
<td>1.39</td>
<td>$-0.24^*$</td>
</tr>
<tr>
<td>‘A child who has almost drowned is less likely to suffer brain damage if someone can start CPR before the rescue crew arrives’</td>
<td>1.72</td>
<td>$0.33^{**}$</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘It would be very hard for me to find time to take a CPR class’</td>
<td>4.59</td>
<td>0.27</td>
</tr>
<tr>
<td>‘Even if I was trained, I think I would be too upset to perform CPR on my child in an emergency’</td>
<td>4.29</td>
<td>0.19</td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.01. Bold typeface indicates that the observed difference was in the desired direction.

### Discussion

Women who had watched our drowning prevention video were significantly more likely than control group members to report current training in infant/child CPR 6 months after their babies were born. This conclusion is supported by the fact that significant changes in mean beliefs were observed only for the group of women who were exposed to our intervention.
The significant changes in beliefs that we observed appear to be persistent since our follow-up questions were administered 9 months (on average) after video viewing. The three items related to perceived susceptibility covered facts that were communicated in our video: that drowning is the leading cause of death for toddlers in that region and that child submersion is usually silent. The perceived severity item—which deals with the possibility of victims requiring long term institutionalized care—was not covered directly, but our video portrayed dramatically that brain damage occurs within minutes of submersion. The fact that bystander CPR reduces the likelihood of brain damage was also included in our intervention. A second item related to perceived benefits changed significantly in our Intervention group but not in the desired direction. Video viewers were less likely to agree that if they knew how to do infant/child CPR they would ‘feel like they could save their baby’s life’. Since this group was more likely to contain women who were trained in CPR, we could speculate that these mothers had been informed that resuscitation attempts are often unsuccessful. Naive respondents may assume that confidence/reassurance accrues to trained parents, but trained parents may not feel that they experienced this benefit. Concerns about the psychological effect of CPR training have been raised in relation to family members of patients at risk for sudden cardiac arrest [21], although the preponderance of evidence does not support such concerns.

It would be somewhat unusual for a brief one-off educational intervention to achieve behavior change. Our intervention may have been successful because baseline rates of CPR compliance were low (i.e. 16%). This is not surprising because 96% of the women in our study did not have children yet. Our research participants were recruited from hospital-based prenatal classes, which means that they had the disposition and means to access community resources. They were also, generally, from population subgroups (i.e. upper income, married females) who are more likely to be influenced by preventive health care information [22]. Also, it has been reported that ‘new’ health information is more likely to motivate change, as opposed to advice that is well known to the target audience [23]. While the recommendation for pool owners to take CPR is not new, it may have been perceived as novel/newly salient to this sample of predominantly first-time mothers. Respondents also reported high levels of concern about their child’s drowning risk at baseline. High levels of perceived susceptibility are somewhat uncommon among target audiences [24].

This study was subject to a number of limitations. Measurement of our major outcome—CPR training—was based upon maternal self-reports. In a soft attempt to validate such reports, we asked those who said that they were trained in the post-intervention period where they had taken their class. In all instances, women were able to report a location without hesitation. For 90% of the respondents, we were able to confirm that those sites did, in fact, offer infant/child CPR training. In the other four instances, we made no attempt to confirm that training was offered because it would not have been open to the public (e.g. they reported having been trained at their job/in relation to their work). We did not assess the validity or reliability of the items that were designed to assess Health Belief Model constructs.

It would be reasonable to question the generalizability of these results because our population was self-selected, from a group of mothers who were already attending a provider-based training course. They were also residents of an area where toddler drownings occur with relative frequency. It is possible that these factors made them more receptive to our recommendation to take this secondary drowning prevention measure.

This study was underpowered, which interfered with our ability to explore subgroup differences, such as whether the two versions of the videotape differed in their effectiveness. Fifty percent of the women who saw the tape that featured a mother recounting her son’s drowning were CPR compliant at the end of this trial versus 46% of the participants who saw the other video. This difference was not statistically significant. We can report that 68% of the women who remembered seeing a mother discuss her son’s drowning said that they could relate to her. The mammography study mentioned
earlier, which compared the effectiveness an informational versus narrative-style video intervention, found that the latter was associated with improved behavioral outcomes ‘only for women who had less than a high school education’ [25]. Just one mother in our sample fell within that socioeconomic group.

Conclusions

We recommend that providers of perinatal education who are based in communities with high rates of toddler drowning screen pregnant women for pool ownership. They can then steer those who are eligible to infant/child CPR classes, emphasizing the types of messages that appear to have persuaded a significant proportion of our study population to be trained.

Having said that, we feel compelled to remind readers that parental CPR training is not the most efficacious way to prevent toddler drowning. It relies on a trained parent being present at the time of rescue. It has also been demonstrated that adequate CPR skills are not necessarily imparted to trainees [26–30] and that CPR skills begin to decay soon after they are acquired [18–20, 31]. Most importantly, a child is at risk for permanent brain damage 3–5 min after submersion, followed shortly thereafter by death. Most pediatric survivors of drowning-related cardiac arrest are left ‘neurologically devastated’ [32].

CPR training has value for pool owners, but it opens just a tiny window of opportunity. We recommend that drowning prevention advocates emphasize the need for isolation fencing, and distinguish that countermeasure in the eyes of policy makers and parents who may be comparing the costs and convenience of alternatives like infant swimming lessons, pool covers and door alarms.

Conflict of interest statement

None declared.

References