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Original Research Article

Evaluation of a Drowning Prevention Program Based on Testimonial Videos: A Randomized Controlled Trial

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Abstract

Objective Unintentional drowning is the most common cause of childhood death in rural China. Global intervention efforts offer mixed results regarding the efficacy of educational programs. **Methods** Using a randomized controlled design, we evaluated a testimonial-based intervention to reduce drowning risk among 280 3rd- and 4th-grade rural Chinese children. Children were randomly assigned to view either testimonials on drowning risk (intervention) or dog-bite risk (control). Safety knowledge and perceived vulnerability were measured by self-report questionnaires, and simulated behaviors in and near water were assessed with a culturally appropriate dollhouse task. **Results** Children in the intervention group had improved children's safety knowledge and simulated behaviors but not perceived vulnerability compared with controls. **Conclusions** The testimonial-based intervention's efficacy appears promising, as it improved safety knowledge and simulated risk behaviors with water among rural Chinese children.

Key words: child; China; drowning; prevention; rural; testimonial.

Drowning, defined as *the process of experiencing respiratory impartment from submersion/immersion in liquid* (WHO, 2015), can be categorized into intentional (suicidal/homicidal) and unintentional drowning. Unintentional drowning is second leading cause of unintentional injury deaths among children ≤14 years old in the United States (following motor vehicle accidents), causing 625 deaths and 40,647 injuries annually (NCIPC, 2015). Internationally, unintentional drowning threatens children even more dramatically, with deaths in low- and middle-income countries accounting for 91% of all global unintentional drowning deaths (WHO, 2015).

For the 150 million children aged <14 years living in rural China, drowning is the leading cause of injury death (WHO, 2015), with death rates three times higher than their counterparts living in urban China (Liu et al., 2012). This heightened risk of drowning is likely owing to a combination of environmental, family, and individual factors. Environmentally, traditional agricultural practice involves residing close to natural bodies of water, including lakes, rivers, and ponds (Ma et al., 2010). Many rural Chinese children, especially in Southeast China, have easy access and high exposure to natural bodies of water in their daily life, and safety measures such as high fences or warning signs are rare (Ma et al., 2010; Yang, Nong, Li, Feng, & Lo, 2007).

From a family perspective, many young parents in rural China migrate to urban Chinese cities for higher-paid jobs (according to the China National Bureau of Statistics, over 240 million people migrated from rural to urban China in 2014), resulting in a large portion of "left behind" rural children, who are reported to

lack adequate adult supervision and demonstrate more problems in health behavior than other children (Wen & Lin, 2012; Ye & Pan, 2011). Correspondingly, epidemiological studies on pediatric drowning in rural China confirm lack of close supervision by adults/caregivers as a significant risk factor for drowning (Ma et al., 2010; Yang et al., 2007). From an individual perspective, characteristics of the children themselves also contribute to drowning risk. Developmentally, young children may have poor swimming skills, poor impulse control, overestimated ability to handle situations in and near water, and underestimated vulnerability toward drowning risk (Ma et al., 2010; Shen et al., 2013a).

A recent systematic review of interventions to reduce pediatric drowning risk uncovered seven studies meeting rigorous inclusion criteria (case-control design and some level of subjective/objective behavioral measures among children <19 years old, published between 1980 and 2010) (Wallis et al., 2015). Among the seven intervention studies, three used educational strategies with information-based lessons on drowning prevention (Bennett, Cummings, Quan, & Lewis, 1999; Gresham et al., 2001; Posner, Hawkins, Garcia-Espana, & Durbin, 2004), two incorporated formal swimming lessons (Asher, Rivara, Felix, Vance, & Dunne, 1995; Brenner et al., 2009), and two used pool fencing (Morgenstern, Bingham, & Reza, 2000; Pitt & Balanda, 1991). Just two of the included studies were designed as randomized controlled trials (RCT) and most focused on children <4 years old. Collectively, these studies offer little empirical evidence concerning effective behavioral interventions to reduce drowning risk among school-aged children (Wallis et al., 2015).

In recent years, comprehensive educational programs that combine safety information and swimming practice such as Swim to Survive (Scarr, 2010; Swim to Survive, 2006), Swim and Survive (2012), and PRECISE (Rahman, Rahman, Mashreky, & Linnan, 2009) have been developed to offer both informative and practical educational lessons to prevent pediatric drowning across a broader age range around the globe.

Within China, few intervention programs are documented at all. Among those published in peer-reviewed journals, intervention targets are usually medical personnel and younger children's caregivers, with outcome measures assessed in pre–post designs and unadjusted for potential confounding factors such as exposure to natural water or parental supervision (Guo et al., 2010; Zhang, Chen, Deng, Xu, & Hu, 2003; Zhuo et al., 2010). Our systematic searches in the English- and Chinese-language literatures did discover one unpublished thesis that documented the effectiveness of a school-based educational program (lessons and activities organized by school teachers) to prevent drowning among 3,015 rural Chinese children in Grades 4–6 using a clustered case-control design (Guo, 2010). The participants in the intervention group (four of the eight participating schools) were found to have significantly increased safety knowledge and decreased self-reported risky behaviors, although no difference in self-reported drowning rates were detected immediately following the end of the 18-month program. Although Guo (2010) provides preliminary evidence for the potential promise of school-based intervention on drowning prevention, the study suffered from the reliance on self-report for all outcome measures and lack of control for school cluster effects.

For all existing interventions, one element that is often overlooked is the mechanism of behavior change: What causes children to behave more safely in and near water following an intervention? According to the Health Belief Model, both high perceived vulnerability (along with high perceived severity and benefit:cost ratio) and adequate health-related knowledge are likely to create health behavior change (Janz & Becker, 1984). This focus has been applied to the understanding and prevention of drowning among children in North America (Morrongiello & Kiriakou, 2004; Schwebel, Lindsay, & Simpson, 2007) as well as other types of pediatric injuries such as playground injury, dog-bite injury, and home safety promotion (Brown, Roberts, Mayes, & Boles, 2005; Hillier & Morrongiello, 1998; Morrongiello & Matheis, 2007a, b; Morrongiello, Zdzieborski, Sandomierski, & Lasenby-Lessard, 2009; Peterson, Farmer, & Kashani, 1990).

Among interventions to improve child safety in North America, videos are sometimes used as a medium to deliver interventions to children both effectively and efficiently (Brown et al., 2005; Morrongiello & Matheis, 2007b; Morrongiello et al., 2009). Research in communication psychology suggests first-person testimonials, which can elicit strong emotional arousal especially among children, are effective to alter individuals' perceived vulnerability toward health-related behaviors (De Wit, Das, & Vet, 2008; Loewenstein, Weber, Hsee, & Welch, 2001; Slater & Rouner, 1996). Thus, this study incorporated testimonial-based videos to efficiently and effectively change children's injury-related behaviors near water. This strategy was effective recently in reducing children's risk of dog-bite injury in rural China (Shen, Pang, & Schwebel, 2015).

The present study used a randomized repeated measures intervention-control design (allocation ratio 1:1 with no changes in design after trial commencement) to evaluate the efficacy of a testimonial-based video intervention on reducing drowning risk among school-aged children in rural China. We hypothesized

that children in the intervention group who watched the testimonials would obtain higher scores on safety knowledge, perceived vulnerability, and simulated behaviors around water than those in the comparison group. We also performed a secondary exploratory analysis evaluating potential constructs that might influence the efficacy of the intervention.

Methods

Participants

Power analysis was performed *a priori* and minimum sample size calculated based on the following procedure. An estimated effect size of $d = 0.33$ for the intervention effect was determined based on results from a similar video-based intervention study of playground safety in Canada (Morrongiello & Matheis, 2007b). It was determined that 76 participants in total would be required to detect the expected effect of the main outcomes between the intervention and comparison groups with a power of 0.99 (two tails, $\alpha = .01$) using G*Power 3.1; our anticipated sample from any single elementary school in rural China was much larger.

A total of 280 children attending 3rd and 4th grade at an elementary school in rural Zhejiang Province, China, participated. All participants were enrolled by the lead researcher and three research assistants. The participating school was selected based on risk for drowning in the local area and accessibility. The natural environment of Zhejiang Province and Southeast China creates increased risk owing to abundant natural and manmade bodies of water in the region. All children in the 3rd and 4th grade of the participating school at the time of study were eligible to participate with no exclusion criteria. The children had a mean age of 10.03 years ($SD = 0.83$) and were 52% girls and 92% of Han Chinese ethnicity. Children's caregivers reported an average annual household income of <$48,000 Chinese RMB (about U.S. $8,000), and 85% of caregivers reported <10 years of formal school education.

Institutional review board approval was obtained from University of Alabama at Birmingham, and written consent was obtained from the participating school. Signed informed consent was obtained from students' caregivers, and signed informed assent was obtained from students. All children in Grades 3–4 (100%) at the participating school consented to participate in the study. As shown in Figure 1, there was no attrition throughout the study, although 4 (1%) children did not complete the preintervention dollhouse task owing to scheduling conflicts.

Measures

The present study considered three primary outcomes: safety knowledge about drowning prevention, perceived vulnerability toward drowning, and simulated behavior with water. Because no existing outcome measures existed to evaluate the outcome constructs of interest, we developed our own measures and instruments to assess the outcomes following a rigorous set of six steps: (a) thorough review of scientific literature and internet (using structured search strategies) for appropriate content areas on pediatric drowning globally and in rural China, (b) preparation of draft items in English by the leading author, (c) expert review, face validity review, and editing of items by senior researchers familiar with Chinese culture, (d) translation and back-translation from English to Chinese by social scientists fluent in both languages (small differences in translation were resolved through discussion), (e) second round of expert review, face validity review, and editing of items by senior researchers familiar with Chinese culture, and (f) final review and approval by the lead author. This sort of instrument development is common in child injury prevention RCT, as there are few existing validated measures to assess outcomes in most domains of child injury risk (Schwebel, Morrongiello, Davis, Stewart, & Bell 2012; Shen et al., 2015). The use of a simulated dollhouse measure to assess anticipated behavior near water, detailed below, was adapted from related work (Morrongiello et al., 2013; Schwebel et al., 2012; Shen et al., 2015) and offers method variance that extends beyond use of self-report measures alone.

Child Safety Knowledge

The *Child Safety Knowledge on Drowning Risk Questionnaire* is a 12-item self-report measure of children's knowledge about safety around water. The questionnaire measures children's knowledge about the "dos" and "don'ts" when playing in and near water in typical rural Chinese daily life. An example item is, "*Mei and her friends have been swimming in the river for several years. They are very good at swimming. So it's safe for them to___ A. Play hard in water just occasionally; B. Swim into deeper water and explore the world under the water in the river; C. Swim without adults present; D. None of the above is safe.*" The correct answer is D. Children were scored on the percentage of correct responses (0–100%), with higher scores indicating higher levels of safety knowledge about drowning risk. The questionnaire demonstrated adequate test–retest reliability ($r = .58$, $p < .001$), and Mean- and Variance-adjusted Weighted Least Square (WLSMV)-based confirmatory factor analysis supported moderate unidimensionality ($\chi^2/df = 1.82$, $p < .05$; RMSEA = 0.06; CFI = 0.75; SRMR = 0.11). The questionnaire also showed adequate construct validity (significant correlations with perceived vulnerability, $r = .46$, $p < .01$; daily risky practice with water, $r = -.10$, $p < .01$; and simulated

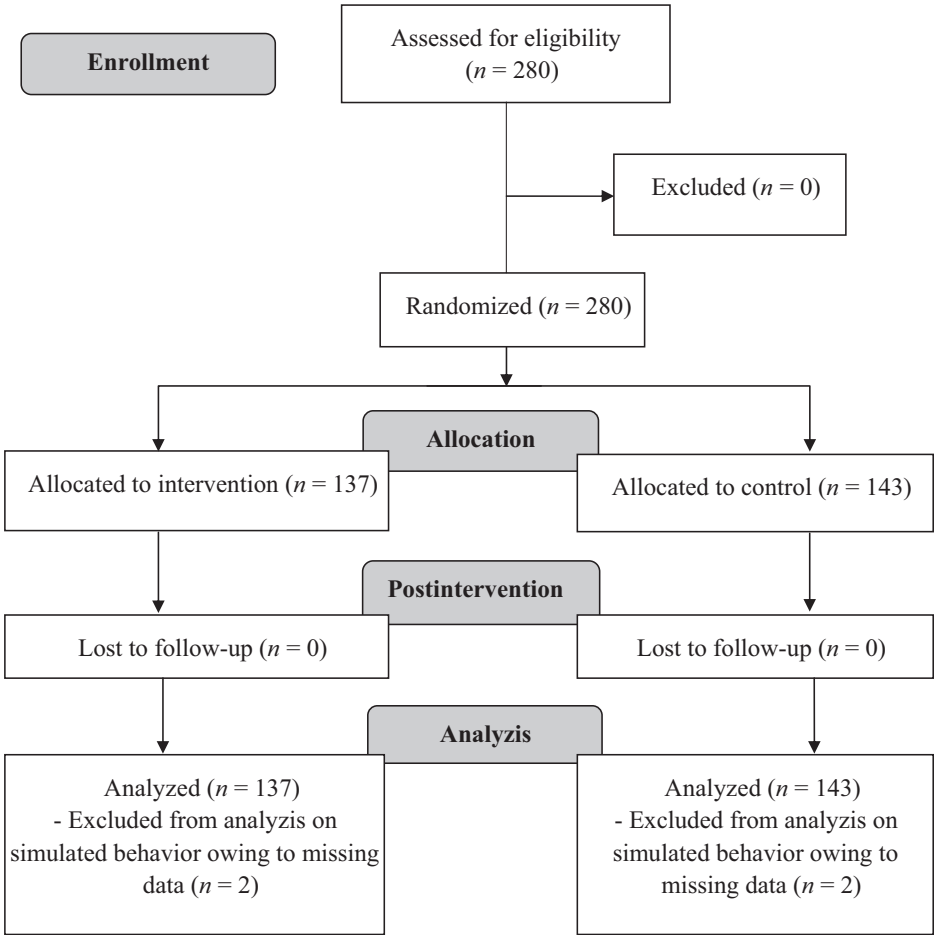

Figure 1. The Consort Flowchart Diagram of study enrollment.

safe behavior in the dollhouse task in preintervention tests, $r = -.40$, $p < .01$).

Child Perceived Vulnerability

The *Child Perceived Vulnerability toward Drowning Risk Questionnaire* is a self-report measure consisting of 15 items assessing children's perceived vulnerability toward risks when playing in and near water in typical rural Chinese daily life. An example item is, "*I think drowning only happens to those who are not good at swimming.*" Children answered each item on a 5-point scale to indicate the extent they agreed with each statement. Final scores were computed as the average of all items, with a possible range from 1 to 5. Higher scores indicate a higher level of risk perception, and items were reverse-coded if needed to reflect the construct of perceived vulnerability. The questionnaire demonstrated strong internal reliability (Cronbach's $\alpha = .84$).

Child Simulated Behaviors in and Near Water

Based on a model used previously in the United States (Schwebel, Morrongiello, Stewart, & Bell, 2012), we developed a *culturally adapted dollhouse task* to measure children's simulated behaviors with and around water in a typical rural Chinese setting. Children were asked to act out what they would do in eight different situations involving play in and near water using a dollhouse model. An example scenario is as follows: "*Researcher acts out child going swimming with a friend. They see a warning sign at the shore (pointing to Pond #2 in the dollhouse model). Researcher says: 'You and your best friend decide to go swimming in a new large pond you have never visited before. When you get there, you see a warning sign saying it's dangerous to swim in this pond. Your friend promises it's OK because he/she has seen other kids playing in the pond before and the sign is not that important. What will happen next?'*" Children's verbal and behavioral responses to each scenario were recorded verbatim and then coded as safe (0, low risk of drowning), moderate (0.5, moderate risk of drowning), or unsafe (1, high risk of drowning) by the researcher using an objective written coding system established before the study. As an example, for the scenario provided above a participant who responded or showed the child doll leaving to go home would have received a 0, a participant who showed the child doll playing with the peer on the shore but not the

water would have received a 0.5, and a participant who showed the child doll ignore the warning and swim would have received a 1. Final scores were the average across all eight scenarios and therefore ranged from 0 to 1, with higher scores indicating more risky simulated behaviors with/around water. In pilot testing with 60 children, interrater reliability was obtained by a second researcher who did not communicate with the first researcher and was excellent (kappa > .95). This task demonstrated adequate internal reliability (Cronbach's $\alpha = .74$).

Demographic and Water-Related Information

The child-report *Demographic Sheet for Children* collected information on children's birthdates, gender, ethnicity (Han Chinese vs. ethnic minority) along with the following water-related information:

- *Near-drowning experience*, "*How many times have you almost drowned in water?*" Owing to skewed distribution, answers were dichotomized to having near-drowning experience versus no near-drowning experience.
- *Exposure frequency to water*, "*How often do you see open water (ponds, lakes, rivers, reservoirs, etc.) in your daily life?*" Scores ranged from 1 (*less than once a year*) to 3 (*at least once a day*).
- *Swimming ability*, "*Can you swim?*" Responses were rated on a 5-point scale and dichotomized for analysis (owing to skew) into *having the ability to swim/float in water* (1) versus *not having the ability to swim/float in water* (0).
- *Daily risky practice with/around water*. A 9-item instrument with items answered on a 5-point scale, final scores were computed as the average across items and ranged from 1 to 5. Higher scores indicating riskier practice and Cronbach's $\alpha = .72$.

A separate *Demographic Sheet for the Primary Caregiver* obtained caregiver-report of their own educational background and monthly household income in Chinese RMB yuan. Education and household income scores were standardized and then averaged to produce a socioeconomic status (SES) composite used in data analysis.

The Testimonial-Based Interventions

The *Testimonial-based Intervention on Drowning Prevention* is a 36-min video consisting of four testimonial stories about actual near-drowning experiences that occurred in rural China (see Supplementary Material for sample script). The testimonials, written to represent common situations school-aged children might face, were presented by adult actors who were native Mandarin Chinese speakers unfamiliar to the participating children. Adults rather than child actors were chosen because as part of a collectivist culture, Chinese children, especially in rural areas, respect adult authorities and are more likely to adhere to adults' admonitions than those from peers (Chen, Greenberger, Farruggia, Bush, & Dong, 2003; Ma, Shek, Cheung, & Lam, 2000). Further, the adult roles in the testimonials were chosen with careful consideration to represent the interpersonal environment rural Chinese children are familiar with in terms of gender ratio (three females and one male, as mothers are more likely to care for children and school teachers are mostly female) and societal roles (school teacher, father, mother, grandparent) (Lu, 2012; Shen, Li, Xiang, Lu, & Schwebel, 2014).

To achieve uniform presentation and standardized educational objectives, the testimonials were scripted before recording. Rooted in process analysis (Peterson et al., 1987), each 9-min video was composed of the following six parts: (1) introduction of the presenter, including her/his name and role as teacher, parent, or grandparent of the child victim; (2) introduction of the child victim who nearly drowned, including the child's name, gender, personality, and hobbies relevant to the incident; (3) the antecedents/circumstances of the near-drowning incident (i.e., how the child got near/into the water; what the child, peers, and nearby adults were doing at the time of the incident); (4) physical and psychological consequences of the near-drowning incident, including treatment at the hospital and behavioral influence on the child's daily life; (5) mistakes, decisions, and actions the child victim made that led to the incident, as well as alternative actions that would have been safer; and lastly (6) a summary of safety lessons viewers could learn from this incident. Actors presented information in a serious and grave manner, and the testimonial videos were edited with background melodies and illustrative pictures and text to create a vivid and emotion-arousing experience.

Children in the intervention group watched all four testimonials in the same order. Children in the comparison group viewed a different 36-min testimonial video consisting of four testimonials on dog-bite prevention. Those testimonials were created to be of the same length and structure as the drowning testimonials and therefore offer a comparable active control group. The same actors presented both sets of stories. Like drowning, dog bites are also among the leading causes of unintentional injury to children in rural China (Shen et al., 2013a, 2013b, 2014).

Procedure

We implemented a randomized controlled trial with three stages: (1) preintervention evaluation of outcome and demographic variables; (2) randomized group assignment (intervention vs. comparison) and intervention implementation; and (3) postintervention evaluation of outcome variables.

The study was completed in 3 weeks. In the first week (May 5–9, 2014), all participating children were assessed in their classroom on their level of safety knowledge and perceived vulnerability using

self-report questionnaires, as described in the "Measures" section. Also during that week, participating children were taken to a separate quiet room and individually tested in randomized order on their simulated behavior with/around water using the dollhouse task. Demographic information was also collected during the first week. Children completed the brief questionnaire on demographic information and their previous experience with water in their classroom, and children took the caregiver demographic questionnaire home for completion by their caregiver, and returned it to school. Both researchers and children were masked to intervention group membership at this stage because group assignment occurred following completion of the preintervention tests.

In the second week of the study (May 12–16, 2014), all children watched the testimonial videos at individual desktop computers with headphones in the school's computer room. Children were randomly assigned to sit at a particular computer by the lead researcher or a research assistant based on a computer-generated list of random numbers the lead researcher programmed a computer to produce. Individual computers in the classroom were randomly programmed to display either the testimonials on drowning prevention (intervention group) or testimonials on dog-bite injury prevention (comparison group). An equal number of computers displayed each. To reduce clustering effects in data analysis, we randomized the sample by child rather than classroom using simple randomization. The randomization sequence was generated immediately before the intervention session and after all participants completed pretests so all researchers were masked to the sequence during preintervention assessment. Computerized randomization within the intervention program occurred on site as a child began the training session, so researchers had no prior knowledge about which child would be in which training condition. Children were also masked to random assignment until it was made.

In the third week (May 19–23, 2014), postintervention tests were performed on major outcome variables using the same procedure as the preintervention tests. Researchers performing postintervention tests were masked to children's intervention group assignments and were prohibited during postintervention testing from asking the child what testimonial videos he/she had viewed.

The study ended after completion of all data collection, as planned. No changes to trial outcomes were made after the trial commenced.

Plan for Data Analysis

Descriptive analysis was performed first. Chi-square tests and independent samples *t* tests were computed to examine differences between the intervention and comparison groups on demographic variables and preintervention outcome variables and to ensure randomization was effective. Following these preliminary analyses, we tested our primary hypotheses, whether the testimonial-based intervention on drowning safety improved children's safety knowledge, perceived vulnerability, and simulated behaviors with/around water compared with the control group. These tests were conducted using one-way analysis of covariance (ANCOVA), with training condition as an independent variable, postintervention outcomes as respective dependent variables, and preintervention scores on the respective outcomes as well as demographic and water-related variables (age, gender, ethnicity, SES, near-drowning history, exposure frequency to water, swimming ability, risky practice with water) serving as covariates. Partial η^2 was calculated as measure of effect size for each outcome variable and represented the proportion of the total variability in each outcome attributable to the intervention. Experts generally consider a small effect size for partial η^2 as .01, a medium effect size as .06, and a large effect size as .14 (Miles & Shevlin, 2001).

We next explored demographic and water-related factors that might be associated with the efficacy of the intervention among the intervention group only. Correlation analyses were computed first, followed by three multiple regression models. The regression models included change scores on safety knowledge, perceived vulnerability, and simulated behavior as respective dependent variables, with demographics (age, gender, ethnicity, SES) and water-related experiences (near-drowning history, exposure to water, swimming ability, daily risky practice) as independent variables. All analyses were conducted in SPSS 21.0.

Results

No significant outliers were detected for any variable and no severe deviation from normality was detected for the outcome variables. Table I presents descriptive statistics for demographic and outcome variables (pre- and postintervention), both for the entire sample and for the intervention and comparison group, respectively. As expected given randomization, no statistically significant difference appeared between the two groups on any of the demographic (age, gender, ethnicity, SES), water-related experience (near-drowning history, exposure to water, swimming ability, daily risk practice with water), or preintervention outcome variable scores (safety knowledge, perceived vulnerability, simulated behavior).

Next, one-way ANCOVA was performed to examine group differences (by original assignment) in the effect of the testimonial-based intervention on children's postintervention safety knowledge, perceived

Table I. Descriptive Data for Demographics, Water Experience, and Outcome Scores: Percentages and Mean (SD)

Variable	Overall ($N = 280$)	Intervention ($N = 137$)	Control ($N = 143$)	x^2	p
Age (years)[a]	10.03 (0.83)	10.02 (0.84)	10.03 (0.82)	0.17	0.87
Gender					
% male	48.9	50.7	47.2	0.35	0.55
Ethnicity					
% Han	91.8	90.4	93	0.61	0.44
Caregiver formal education					
% no school education	6.9	6.7	7		
% elementary school	35	39.3	31		
% junior high school	43.3	40	46.5	2.56	0.63
% senior high school	13	11.9	14.1		
% ≥ college	1.8	2.2	1.4		
Annual household income					
% ≤48,000 RMB (~$8,000)	54.4	55.6	53.2	3.78	0.44
Near-drowning history					
% yes	21.8	21.2	22.4	0.06	0.81
Exposure to water					
% < once a year	20	17.5	22.4		
% ≥ once a year but not everyday	28.2	33.6	23.1	4	0.14
% at least once everyday	51.8	48.9	54.5		
Swimming ability					
% I cannot swim	59.6	60.2	59.1		
% just enough to keep myself floating in the water	14.8	16.5	13.1	1.77	0.78
% can swim <10 m	12.6	11.3	13.9		
% can swim 10–50 m nonstop	6.7	5.3	8		
% can swim >50 m nonstop	6.3	6.8	5.8		
Daily risky practice[a] (1–5 scale)	1.60 (0.47)	1.59 (0.48)	1.62 (0.46)	0.5	0.62
Presafety knowledge[a] (0–100%)	64.17 (18.36)	63.89 (17.48)	64.44 (19.22)	−0.25	0.8
Preperceived vulnerability[a] (1–5)	4.47 (0.49)	4.44 (0.49)	4.51 (0.48)	1.18	0.24
Presimulated behavior[a] (0–1)	0.23 (0.22)	0.26 (0.24)	0.21 (0.19)	−1.62	0.11
Postsafety knowledge[a] (0–100%)	74.55 (17.20)	76.40 (15.71)	72.79 (18.39)	1.76	0.08
Postperceived vulnerability[a] (1–5)	4.68 (0.43)	4.67 (0.43)	4.68 (0.42)	0.11	0.91
Postsimulated behavior[a] (0–1)	0.21 (0.21)	0.19 (0.19)	0.23 (0.22)	1.61	0.11

Note. [a]Mean (*SD*) are reported for this continuous variable, and independent samples *t* test was performed and reported.

Table II. ANCOVA Results for the Effect of Testimonial-Based Intervention on Postintervention Outcomes (N = 280)

Outcome	Source	*SS*	*df*	*MS*	*F*	*p*	Partial η^2	95% CI for η^2
Safety knowledge[a]	Condition	1,336.77	1	1,336.77	7.04*	.008	.03	0.002–0.08
	Error	47,484.54	250	189.94				
Perceived vulnerability[b]	Condition	0.03	1	0.03	0.27	.60	.001	0.000–0.02
	Error	26.34	250	0.11				
Simulated behavior[c]	Condition	0.24	1	0.24	8.27*	.004	.03	0.003–0.09
	Error	7.00	245	0.03				

Note. Respective preintervention scores and demographic variables (age, gender, ethnicity, SES, near-drowning history, exposure frequency to water, swimming ability, risky practice with water) were entered as covariates for the analyses.
[a]Adjusted $R^2 = 0.33$.
[b]Adjusted $R^2 = 0.41$.
[c]Adjusted $R^2 = 0.30$.
*$p < .01$.

vulnerability, and simulated behavior scores. As shown in Table II, we found a significant effect of the testimonial-based intervention on children's safety knowledge and simulated behaviors, but not children's perceived vulnerability toward drowning risk. Specifically, after controlling for demographics and preintervention scores on safety knowledge, there was a significant main effect of intervention group on children's safety knowledge about drowning prevention ($F(1, 250) = 7.04$, $p = .008$, partial $\eta^2 = .03$, small to medium effect size) and their simulated behaviors with water in the dollhouse task ($F(1, 245) = 8.27$, $p = .004$, partial $\eta^2 = .03$, small to medium effect size). The main effect of intervention group on children's perceived vulnerability was not statistically significant ($F(1, 250) = .27$, $p = .60$, partial $\eta^2 = .001$).

After establishing that the intervention had the hypothesized effect on children's knowledge and behavior, we conducted exploratory analyses to examine factors that might contribute to the efficacy of the

testimonial-based intervention. To achieve this goal, we conducted analyses only on the subset of the sample randomly assigned to the intervention group. We first constructed a correlation analysis testing associations between changes in outcomes from preintervention to postintervention (safety knowledge, perceived vulnerability, simulated behaviors) and potential predicting factors (Table III).

Three multiple linear regression models were constructed with demographics (age, gender, ethnicity, SES) and water-related factors (near-drowning history, exposure to water, swimming ability, daily risky practice) as independent variables, and respective change scores between pre- and posttests served as dependent variables (Table IV). The first model considered changes in safety knowledge. Younger age ($B = -4.52$, $\beta = -.24$, $p < .05$) was associated with greater improvements in children's safety knowledge following the intervention. The second model considered changes in perceived vulnerability status and found that being of non-Han ethnicity ($B = -0.25$, $\beta = -.19$, $p < .05$) and having higher levels of daily risky practice in/near water were associated with greater improvement in perceived vulnerability after the intervention. The last model considered changes in simulated behavior. No factors we tested were associated with changes in children's risky simulated behaviors after the intervention.

No harms or unintended effects were detected in the sample.

Discussion

The present study used a randomized controlled trial to evaluate the efficacy of a video-based testimonial intervention on reducing unintentional drowning risk among school-aged children in rural China. The testimonial-based intervention strategy improved children's safety knowledge on drowning risk (small to medium effect size) and safe simulated behaviors related to playing in and near water in the dollhouse task (small to medium effect size). It had minimal impact on children's perceived vulnerability to drowning risk.

The effect of the testimonial-based intervention on children's safety knowledge for drowning risk was not surprising considering the educational nature of the testimonial videos. It was also consistent with other existing educational programs on drowning prevention (Wallis et al., 2015). The successful promotion of children's safe simulated behaviors in and near water further supports the ecological efficacy of testimonial-based interventions and adds to the current literature on drowning prevention programs that largely focused on increasing children's knowledge (Gresham et al., 2001; Posner et al., 2004, but see Bennett et al., 1999 and Schwebel et al., 2007 for exceptions).

Previous research has successfully used video-based intervention to change children's injury-related beliefs or perceived vulnerability in other types of injury such as playground injuries (Morrongiello & Matheis, 2007b). Contrary to our hypotheses, results of the present study did not reveal a significant improvement on perceived vulnerability among children in the intervention group compared with the comparison group. In considering how to explain this null result, post hoc analyses revealed that children in the intervention group did show significant increase in perceived vulnerability after the testimonial-based intervention compared with their pretest scores. However, similar trends appeared also in the comparison group who watched a testimonial video on dog-bite prevention. Thus, it may be that the testimonial videos induced a generic effect of increasing perceived vulnerability and the content of the testimonials (dog-bite prevention vs. drowning prevention) exerted only a small influence on domain-specific perceptual change. Also possible is that exposure to the preintervention testing (e.g., the

Table III. Correlation Matrix for Major Outcome and Demographic Variables in the Intervention Group (N = 137)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age (years)	—													
2. Gender (1 = M, 0 = F)	.08	—												
3. Ethnicity (1 = Han, 0 = other)	.02	−.02	—											
4. Socioeconomic status	−.06	.04	.12	—										
5. Near-drowning history (1 = yes, 0 = no)	.15	.10	.04	−.05	—									
6. Exposure to water (1–3)	.12	−.04	.01	−.03	−.01	—								
7. Swimming ability (1 = yes, 0 = no)	−.02	.00	−.04	−.20*	.07	−.05	—							
8. Daily risky practice (1–5)	−.14	.15	−.15	−.14	.09	−.05	.27**	—						
9. Presafety knowledge (0–100%)	.34**	.09	−.08	.08	−.07	.07	−.16	−.31**	—					
10. Preperceived vulnerability (1–5)	.20*	.01	.06	.12	−.09	.17	−.14	−.52**	.46**	—				
11. Presimulated behavior (0–1)	−.19*	.12	.03	−.08	.06	−.06	.09	.30**	−.40**	−.32**	—			
12. Change in safety knowledge	−.25**	−.08	−.04	.18*	.03	−.01	.001	.13	−.58**	−.14	.03	—		
13. Change in perceived vulnerability	−.14	−.15	−.21*	−.08	.03	−.06	.02	.22*	−.06	−.55**	−.07	.15	—	
14. Change in simulated behavior	.13	−.05	.08	−.09	−.10	−.05	−.10	−.22*	.14	.13	−.65**	−.06	−.02	—

Note. *$p < .05$; **$p < .01$.

dollhouse task and questioning) increased children's perceived vulnerability in both groups. A third explanation is the influence of a ceiling effect on the perceived vulnerability measure, which used a 5-point scale and had means of about 4.5 and standard deviation of about 0.5 in preassessment testing for both groups.

When exploring factors that contributed to the intervention's differential efficacy, younger children were found to gain greater improvement in their safety knowledge about drowning prevention following the intervention. This association may have emerged simply because younger children had a lower level of knowledge before the intervention. We also found that improvement in perceived vulnerability was associated with belonging to an ethnic Chinese minority group. Ethnic Chinese minority parents are more likely to be present at home and therefore may offer more drowning risk education to their children than the majority Han Chinese parents (Sun, Cao, Zhang, & Chen, 2014). Finally, we found that higher levels of daily risky practice in/near water was associated with greater improvement in perceived vulnerability after the intervention, perhaps owing to the fact that children who more frequently engage in daily risky practice with water were more likely to empathize with the testimonial stories, and hence were more likely to change their perception of drowning risk after viewing the intervention video.

Strengths of this study included the development and utilization of testimonials in the educational program, the inclusion of objective behavioral measures in a realistic simulated task, and the evaluation of the intervention in a relatively large sample of school-aged children in rural China where risk of drowning is high and empirical research is lacking. There were also several limitations. First, our sample was restricted to children in two grades at a single rural Chinese elementary school, which limits generalizability of our findings to other populations and developmental stages. Second, there was some risk of contamination among the sample. We did eliminate clustering effects through use of random assignment within classrooms and we showed identically timed testimonial videos on similar topics to both groups of children, but we still may have suffered from contamination of information across groups of children who attended the same school. Third, the behavioral outcome in the current study was only assessed in a simulated dollhouse task. Although we boosted ecological validity through adoption of rural Chinese architecture and landscape in the model, cooperation with local designers and builders for the dollhouse construction and implementation of culturally relevant stories, the task may not accurately represent children's actual behavior in or near real rather than simulated water. Fourth, some of our outcome measures had suboptimal psychometric properties. Especially concerning was the relatively low reliability demonstrated in the knowledge questionnaire. Such psychometric properties are common in the injury prevention field where well-validated measures are often unavailable, and continued effort to develop well-validated and reliable measures of injury risk knowledge, behaviors, and perceptions are needed in the field. Fifth, the current study only assessed children's cognitive and behavioral outcomes 1 week after the intervention, which could lead to potential test–retest bias owing to the short time window between measurements. Further research is needed to assess the intervention's long-term effect and its influence on children's drowning rates over time.

Implications of this study are twofold. Theoretically, the positive results indicate the benefit of creating intervention programs grounded in behavioral theory. Testimonial-based intervention may have potential for broad development and implementation in other domains. From a practical standpoint, given drowning status as the leading cause of pediatric death among the 150 million children in rural China, our findings offer initial empirical evidence of an easy-

Table IV. Exploratory Analysis: Factors Contributing to Outcome Changes in the Intervention Group (N = 137)

Independent variable	1. Change in safety knowledge			2. Change in perceived vulnerability			3. Change in simulated behavior		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Demographic factors									
Age (years)	−4.52	1.74	−.24*	−0.04	0.04	−.09	0.02	0.02	.09
Gender (1 = male, 0 = female)	−2.75	2.88	−.08	−0.13	0.07	−.16	−0.01	0.04	−.02
Ethnicity (1 = Han, 0 = other)	−2.21	4.73	−.04	−0.25	0.12	−.19*	0.06	0.06	.10
Socioeconomic status	3.90	2.03	.17	−0.04	0.05	−.08	−0.05	0.03	−.18
Water-related factors									
Near-drowning history (1 = yes, 0 = no)	3.96	3.51	.10	0.11	0.09	.11	−0.04	0.04	−.08
Exposure to water (1–3)	0.76	1.86	.04	−0.03	0.05	−.05	−0.02	0.02	−.07
Swimming ability (1 = yes, 0 = no)	0.66	3.05	.02	−0.07	0.08	−.08	−0.03	0.04	−.07
Daily risky practice (1–5)	4.03	3.16	.12	0.17	0.08	.21*	−0.07	0.04	−.18

Note. *$p < .05$.

to-disseminate program that could reduce health risk among this large but vulnerable population.

Supplementary Data

Supplementary data can be found at: http://www.jpepsy.oxfordjournals.org/.

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