

# Compliance with an Ordinance Requiring the Use of Personal Flotation Devices by Children in Public Waterways

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**Introduction:** For children ages 1-14, 21.6% of drowning cases involve swimming, wading, or playing in natural bodies of water, such as rivers and lakes. Personal flotation devices (PFDs) are believed to be an effective prevention measure. We measure compliance with city and county ordinances, publicized but not actively enforced, requiring that PFDs be worn by children accessing public bodies of water in Sacramento County, California.

**Methods:** During June-August 2010, volunteers conducted 79 observation sessions at three popular local river beaches where PFDs were available for use at no cost. They recorded personal characteristics and PFD use for 1,727 children in or very near the water and believed to be 0-13 years of age (the age covered by the ordinances). We used logistic regression to quantify differences in use by subject characteristics and study site.

**Results:** The prevalence of PFD use was 29.9% overall, with large and significant differences by age: < 1, 55.6%; 1-4, 37.6%; 5-10, 29.4%; 10-13, 14.6%;  $P < 0.0001$ . Usage did not vary significantly by sex or race/ethnicity, and was somewhat higher at one study site (33.1%) than at the others (25.9% and 27.3%),  $P = 0.009$ .

**Conclusion:** The combination of a statutory requirement and a cost-elimination strategy was associated with moderate rates of PFD use that were highest among young children. [West J Emerg Med 2013;14(2):200-203.]

## INTRODUCTION

Drowning is the second leading cause of unintentional injury death among children ages 1-14 in the United States, accounting for 21.2% of such deaths (704 of 3,328) in 2008.<sup>1</sup> On average, 3,427 children ages 1-14 were treated for nonfatal submersion injuries annually during 2001-2010 in United States hospital emergency departments (ED).<sup>1</sup> Of childhood drownings in 2008, 21.6% occurred among children who were swimming, wading, or playing in or near natural bodies of water, such as rivers, lakes, streams, or the ocean. This proportion varies substantially by age: 13.3% for children ages 1-4, 29.0% for children ages 5-9, and 43.1% for children ages 10-14.<sup>1</sup>

The limited available evidence suggests that the use of personal flotation devices (PFDs) may decrease the risk of drowning in natural bodies of water by roughly 50%, for both

adults and children.<sup>2-7</sup> Such studies commonly include no control data<sup>2-4</sup> or pertain to boaters.<sup>5,6</sup> One case-control study of childhood drowning in rural China, with 74% of cases occurring in lakes, rivers, or ponds and none in swimming pools, reported PFD use by 8.3% of cases and 15.0% of controls.<sup>7</sup> Educational programs to promote voluntary use of PFDs have had some success.<sup>8,9</sup> A 3-year effort focused on children at beaches, docks, or pools in King County, Washington, increased their use of PFDs from 20% to 34%, as reported by parents who were aware of the campaign. Parents who were unaware of the campaign reported no change in use.<sup>8</sup>

Sacramento County, California, has 2 large rivers and many smaller natural bodies of water; the southwest corner of the county forms part of the second largest river delta in the United States. It has long been recognized as having a

high rate of fatal submersion injuries.<sup>10</sup> During the 10 years 1998-2007, Sacramento County reported 12 drownings in natural bodies of water among children ages 1-14, for a cumulative incidence (using Census 2000 population data for the denominator) of 4.2 per 100,000 persons at risk.<sup>11,12</sup> The state as a whole reported 96 cases, for a cumulative incidence of 1.2 per 100,000.<sup>11,12</sup> In Sacramento County, as elsewhere, such drownings are associated with recreation and occur most frequently during the summer.<sup>13</sup>

Beginning in 2003, the local emergency medical services agency and fire districts, which are responsible for water rescues in the county, made PFDs available for use without charge by swimmers at popular local river beaches. At one beach, volunteers provided properly fitted PFDs to hundreds of beachgoers.<sup>13</sup> In June 2008, Sacramento County enacted an ordinance making it unlawful for a parent or responsible adult to permit his or her child under the age of 13 to access a public waterway without wearing a Coast Guard-approved PFD.<sup>14</sup> The city of Sacramento adopted an essentially identical ordinance that same year.<sup>15</sup> Violations are misdemeanors punishable by a fine of up to \$500 or 6 months in jail.

PFDs continued to be provided for use at local beaches. Signs reading "KIDS DON'T FLOAT/GIVE THEM SOMETHING THAT WILL/Life Vest Loan Program" and identifying the sponsors of the program were posted in full view of the public. The signs measured approximately 4 feet in height and 8 feet in width; their lower edges were approximately 3 feet above the ground. Affixed to the lower portion of each sign were straps to which 15 PFDs could be attached. Just above the straps were the instructions "BORROW AND RETURN." Additional signs, measuring approximately 6 feet in height and 4 feet in width, spelled out the requirements of the ordinance in 5 languages. In English, this text read "ATTENTION! City and County of Sacramento ordinances make it unlawful for any parent or guardian to allow children under 13 years of age to enter public waters (rivers, lakes, canals), without wearing a personal flotation device." These signs also identified local fire stations at which PFDs were available for loan.

To our knowledge, no sustained enforcement efforts were implemented; compliance was voluntary. During the summer of 2010, we conducted a field observational study of the prevalence of PFD use among children at 3 popular Sacramento beaches.

## METHODS

We collected data collected at 3 sites: Tiscornia Beach, at the confluence of the American River and the Sacramento River; Sand Cove, on the Sacramento River; and Howe Avenue Beach, on the American River. Sand Cove and Howe Avenue Beach are each approximately 100 yards long; Tiscornia Beach is about 300 yards long. These sites were chosen in consultation with a Sacramento fire captain who had made a special study of the problem.<sup>13</sup> Twelve undergraduate

volunteer research assistants from the University of California (UC) Davis Medical Center ED collected data on 28 days (7 Fridays, 9 Saturdays, 12 Sundays) from June 5 to August 22, 2010, between 1:30 and 3:30 PM. All volunteers attended a 1-hour training session, conducted by the lead investigator (AA), prior to collecting data. They were instructed to collect data on all children affected by the ordinance (i.e., those estimated to be less than 14 years of age) in the water or within 5 feet of the water. Observations were to be made of the entire site as quickly as possible to avoid data being collected twice on any single child. Only a few minutes were needed to complete an observation session.

Observers recorded estimated age [ $<1$ , 1-4, 5-10, 10-13 (because of a typographical error, age 10 was the boundary for 2 strata on the data collection sheet)], sex, and ethnicity of the child, and whether the child was wearing a PFD. These devices are brightly colored to increase visibility. Conditions of observation, such as the child being largely under water, occasionally prevented a determination of demographic characteristics. Observations were recorded on paper at the time they were made and later entered into an Excel spreadsheet. We performed data analysis using SAS version 9.1.3 for Windows. Logistic regression was used to generate odds ratios and 95% confidence intervals for PFD use.

The UC Davis Institutional Review Board approved this study.

## RESULTS

A total of 1,739 observations were made during 79 observation sessions (26 each at Howe Avenue Beach and Tiscornia Beach, 27 at Sand Cove). Of these, 12 were excluded because PFD use was not recorded, leaving 1,727 available for analysis. Subject characteristics and the number of observations at each study site are in Table 1.

PFD use was 29.9% overall, with large and significant differences by age and smaller, generally non-significant differences for other personal characteristics (Table 2). Boys were slightly more likely than girls to wear PFDs, and usage rates were lowest among Asian children. PFD use was moderately and significantly more common at Tiscornia Beach, which had 2 PFD distribution stations, than at the other study sites. All these findings persisted, nearly unchanged, in multivariate analysis (Table 2).

## DISCUSSION

At our study sites, where PFDs were available but statutes requiring their use were not actively enforced, the prevalence of PFD use was approximately 30% overall and higher among children less than 5 years of age. This is similar to the 34% reported prevalence achieved in King County, Washington, among children whose parents were aware of a public education campaign promoting PFD use.<sup>8</sup>

Experience with PFD use by children on boats suggests that very high rates of use can be achieved when statutory mandates are enforced. According to Safe Kids USA, 46

**Table 1.** Subject characteristics\* and number of observations at each study site.

Characteristic	Number	%
<b>Age</b>		
<1	27	1.6
1-4	553	32.1
5-10	857	49.7
10-13	288	16.7
<b>Sex</b>		
Female	825	48.4
Male	878	51.6
<b>Race/Ethnicity</b>		
African-American	221	13.2
Asian	77	4.6
Hispanic	815	48.7
White	539	32.2
Uncertain	22	1.3
<b>Study Site</b>		
Tiscornia Beach	866	50.1
Sand Cove	521	30.2
Howe Avenue Beach	340	19.7

\* Conditions of observation precluded data collection as follows: age, 2 cases; sex, 24 cases; race/ethnicity, 53 cases

states require children to wear PFDs while on recreational boats.<sup>16</sup> The U.S. Coast Guard Auxiliary, a largely volunteer organization, shares responsibility for enforcement. A 30-state observational study conducted for the U.S. Coast Guard in 2009 reported prevalences of PFD use among children on boats of 94.7% at age 0-5, 89.1% at age 6-12, and 35.1% at age 13-17.<sup>17</sup>

Higher PFD use among children swimming, wading, or playing in natural bodies of water could likely be achieved if requirements for their use were in place and enforced. PFDs are highly visible; children without them could be fitted with a loaner device on the spot and returned to the water with their recreation only briefly interrupted. These children would likely be accompanied by parents or other responsible adults, providing an immediate opportunity for education. All this could be done at least in part by volunteers, as is the case with boaters.

We are not aware of another similar statute. Both adoption by other jurisdictions and vigorous enforcement should ideally be based on incontrovertible evidence that PFDs are an effective drowning prevention measure. The studies now in the literature do not provide that evidence, unfortunately, though their findings are uniformly positive. The Committee on Injury, Violence, and Poison Prevention of the American Academy of Pediatrics (COIVPP) concludes that PFDs “seem to be effective.”<sup>18</sup>

**Table 2.** Personal flotation device (PFD) use by subject characteristics and study site.

Characteristic	PFD Worn		Crude OR	95% CI	P-value	Adjusted OR*	95% CI	P-value
	N	%						
<b>Age</b>					<0.0001			< 0.0001
<1	15	55.6	7.7	3.3-18.1		9.1	3.8-21.7	
1-4	208	37.6	3.3	2.3-4.8		3.5	2.4-5.1	
5-10	252	29.4	2.3	1.6-3.3		2.4	1.7-3.5	
10-13	42	14.6	Referent			Referent		
<b>Sex</b>					0.079			0.036
Female	230	27.9	0.8	0.7-1.0		0.8	0.6-1.0	
Male	278	31.7	Referent			Referent		
<b>Race/Ethnicity</b>					0.111			0.066
African-American	64	29.0	0.8	0.6-1.1		0.8	0.6-1.2	
Asian	15	19.5	0.5	0.3-0.9		0.5	0.3-0.9	
Hispanic	238	29.2	0.8	0.7-1.1		0.9	0.7-1.1	
White	4	18.2	0.5	0.2-1.4		0.4	0.1-1.0	
Uncertain	176	32.7	Referent			Referent		
<b>Study Site</b>					0.009			0.004
Howe Avenue Beach	88	27.3	0.7	0.5-0.9		0.7	0.5-0.9	
Sand Cove	142	33.1	0.7	0.6-0.9		0.7	0.5-0.9	
Tiscornia Beach	287	33.1	Referent			Referent		

\* All variables in the table are included in the regression model. OR, odds ratio; CI, confidence interval

At the same time, it is clear that teaching children to swim and encouraging close adult supervision are, by themselves, insufficient drowning prevention strategies.<sup>18,19</sup> Only recently has COIVPP relaxed its longstanding advisory against aquatic exposure and swimming lessons for children ages 1-4, and it continues to state that “there is no clear evidence that drowning rates are higher in poor swimmers.”<sup>18,19</sup> While adequate supervision of children in the water requires constant vigilance from nearby, surveys of adults who provide supervision report that up to 46% fail to do so adequately.<sup>4,20</sup>

## LIMITATIONS

This was a short-term, small-area study with observations made only during certain days of the week. No data on PFD use prior to the intervention were available. Determinations of age and race/ethnicity were based on brief observation. Interobserver variability was not assessed. Inadvertently, age 10 was used to bound 2 age strata; the impact of this error is likely to be minor.

## CONCLUSION

Combining multiple prevention strategies, commonly referred to as providing layers of protection, is advisable when no single strategy is sufficient.<sup>4,18,19</sup> While the evidence is not definitive, a recommendation has been made that PFDs be used by children making use of natural bodies of water.<sup>18,19</sup> PFD use is moderate when a requirement is in place and devices are provided but compliance is voluntary.

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