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An Investigation of Youth Swimming Skills and Method of Instruction

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Cover Page Footnote

The authors would like to thank the USA Swimming Foundation for funding this research, and the YMCA of the USA for assisting with implementation of the study.

Abstract

Drowning is a leading cause of death for US children. Teaching youth to swim in a formal setting from certified instructors is a consistent drowning prevention recommendation. Purposes for this investigation was to examine type of swimming instruction and ability to swim and compare to attitudes toward swimming among US youth. Methods were similar to previous USA Swimming studies in 2008 and 2010. YMCA associations in five cities were used to recruit adolescent survey respondents (n=600) aged 12-18 years. Results showed African American youth had the lowest rate of formal swimming instruction (29%) compared to White (32%) and Hispanic (42%) peers. Free/reduced lunch qualifiers reported a 23% formal instruction rate as compared to 43% of non-qualifiers. Formally instructed youth were 2.35 times more likely to report being a skilled swimmer (86%) compared to informally instructed youth (72%). Formal swimming instruction is recommended, and interventions need to target underserved populations.

Keywords: drowning, swimming skill, adolescent, instruction method, interventions

Introduction

Fatal and non-fatal drowning is a serious public health concern for children in the United States (US). According to the Centers for Disease Control and Prevention (CDC), in 2015 there were 786 US children aged 1-18 years who died from drowning, and also notes that drowning is the second leading cause of unintentional injury death for US children in this age range (CDC, 2017a). The American Academy of Pediatrics (AAP) estimates that for every pediatric death due to drowning, there are two non-fatal drowning events requiring hospitalization (AAP, 2010). Also, overall combined costs in the US for this specific diagnosis are noteworthy as they were approximately \$4,748,065,000 in 2010 for all ages and \$1,346,154,000 for children aged 1-18 years (CDC, 2017b). Obviously, the heartache from any child dying from drowning is incalculable.

There are several reasons why children experience drowning, such as lack of supervision and absence of barriers around open water (CDC, 2016a). In addition, swimming ability has been shown in the literature to be a protective mediator against fatal and non-fatal drowning (Yang, Nong, Li, Feng, & Lo, 2007; Brenner et al., 2009). Although swimming competence is not a complete solution to this public health dilemma, the American Academy for Pediatrics (AAP) recommends learning how to swim for every child (Brenner et al., 2010). In fact, after the initial research was released linking swimming ability to lower drowning numbers, the AAP adjusted their previous recommendation, which indicated that parent/caregivers should delay swimming lessons until children were at least 4 years of age (Brenner et al., 2010). The current AAP recommendation is to initiate

swimming instruction when the parent/caregiver believes it is appropriate for the individual child, even if the child is under the age of 4 years.

Minority youth experience fatal drowning at disproportionate rates compared to their White peers, with some age groups reporting three times the rate (Gilchrist & Parker, 2014). In order to support research concerning underrepresented youth swimming patterns, USA Swimming, the national governing body for the sport, has sponsored three nationwide exploratory studies in 2008, 2010, and recently in 2017. All three investigation's overarching purpose was to better understand factors that impact swimming ability which could decrease and possibly eliminate drowning for affected groups.

During the 2008 Phase I study, underserved youth (n=1,680) in six large metropolitan cities (Chicago, IL, Houston, TX, Memphis, TN, Miami, FL, Oakland, CA, & Philadelphia, PA) were surveyed regarding their swimming ability and other associated variables relating to swimming participation. A single survey item from this study categorized swimming ability into five levels: 1) unable to swim; 2) could swim a little, but not comfortable in deep water; 3) comfortable in deep water but cannot swim for very long; 4) able to swim for an extended period of time; and 5) swims competitively--or could. Findings revealed that 58% of African American children (ages 4-17 years) and 56% Hispanic/Latino youth surveyed fell into an "at risk" for drowning category (unable to swim; could swim a little, but not comfortable in deep water). These numbers then compared to 31% "at risk" ability to swim for White participants (Irwin, Irwin, Drayer, Ryan, & Southall, 2008).

An additional national study in 2010 on minority youth swimming patterns used an amended swimming ability question from the original five basic options to ten descriptive choices. The Phase II choices were: 1) Cannot swim at all; 2) Can splash around- shallow end; 3) Can put face in water- blow bubbles; 4) Can hold head under water- 5 to 10 seconds; 5) Can glide a little- face in water- shallow end only; 6) Can swim a little in the deep end- face in water- can float a little; 7) Can swim with a true front crawl stroke- 1 pool length - no stopping; 8) Can swim- front crawl stroke- 2 or 3 pool lengths- can tread water for 5-10 minutes; 9) Can swim 4 or more pool lengths- no stopping- know 3 or 4 different strokes; and 10) Can swim 4 or more pool lengths- no stopping- know 3 or 4 different strokes. This one item extension was designed to better understand a more accurate estimate of aquatic competence for children surveyed (Irwin, Irwin, Martin, & Ross, 2010). According to child developmental experts, most children have difficulty describing complex concepts, such as ascertaining their swimming skill level acquisition (Berk, 2012). Further, asking a child to describe his/her swimming ability can be an exercise in futility as most children will respond that they can swim because they can successfully splash around in the shallow end. Therefore, increasing the number of

choices for each child to assess his/her ability to swim was important to the validity of that most significant question.

Using the more descriptive scale for swimming ability, investigators classified the elusive concept of swimming ability into two main categories of “no or low” and “skilled” with choices 1 – 6 representing “no or low” and 7 – 10 representing “skilled.” Sites for survey distribution during Phase II were Atlanta, GA, Boston, MA, Denver, CO, Memphis, TN, San Diego, CA, and St. Paul/Minneapolis, MN. Results from the 2010 study found that 68.9% of African American youth reported a “no or low” swimming ability, the lowest rate among race/ethnicity subgroups. Also, 57.9% Hispanic/Latino participants noted a “no or low” ability to swim, which compares to 41.8% of White counterparts (Irwin, Irwin, Martin & Ross, 2010).

Learning how to be water safe, which includes knowing how to swim, is an essential step toward drowning prevention. Numerous major health and aquatic organizations, such as the World Health Organization (WHO), the International Life Saving Federation (ILSF), and the CDC, conclusively agree that formally learning to swim with a certified swim instructor is the most effective method (AAP, 2010; American Red Cross [ARC], 2014; CDC, 2016b; ILSF, 2015; WHO, 2014). Recent literature searches have revealed a gap regarding the specific method used most often to instruct children when learning how to swim. The major purpose for this investigation was to examine Phase III results to investigate the method employed when learning how to swim, and then to explore if there was a connection between self-reported swimming competence and swimming instruction method, water safety knowledge, fear of drowning, and enjoyment of swimming among adolescents. Researchers and other aquatic professionals estimated that a formal way of learning how to swim from a certified swim instructor would relate to more positive results toward any swimming variable tested.

Method

USA Swimming Foundation, the charitable organization within the USA Swimming structure, commissioned and funded this third cross-sectional research study. Methodological steps for Phase III research were similar to the Phase I and II studies done in 2008 and 2010. Investigators applied for and received institutional research board approval to guide the Phase III study.

Procedures

During the spring of 2017, the Phase III research study was conducted in five urban cities (Houston, TX, Jacksonville, FL, Las Vegas, NV, Los Angeles, CA, & Memphis, TN), which were chosen in conjunction with USA Swimming and Young Christian Men’s Association (YMCA) recommendations, and also had relatively elevated drowning numbers. The Phase III research team accessed

research participants using YMCA organizations in the previously noted cities to gather survey data. As compared to Phase I and II studies which targeted poor, minority research participants, Phase III aimed to gather data from a more economically balanced sample. YMCA leadership in each city was asked to equitably administer surveys based on income strata of low, middle, and high, and were asked to choose at least 3 branches within their local association that represented these three levels of income status.

The research team scheduled city-site visits for both actual data collection and YMCA staff training to continue data collection after the team had departed. Also, an online training video was offered as a means for follow-up training, and to use with additional staff. A pre-approved protocol was explained during the on-site trainings and included steps for achieving proper consent. Passive consent for adolescent respondents (12-17 years) was fulfilled using a note home to parents. Participants were allowed to stop completing the survey or decline to complete the survey when asked. Research investigators requested that YMCA branch staff use non-swimming program attendees, such as baseball/softball leagues, soccer groups, day-care centers, arts and crafts programming, to administer surveys to reduce self-selection bias. Incentives for participating YMCA organizations included a site-specific report based on their survey results and were offered \$1,000 for achieving research objectives.

Instrument

The Phase III survey instrument was slightly revised from the ones used in the 2008 and 2010 investigations. The Phase III research questionnaire was changed based on statistical testing, as well as verbal feedback from previous survey administrators, participants, and USA Swimming. A panel of aquatic and child development experts examined and gave their approval for the newly modified survey regarding face and content validity. The central swimming ability question from the Phase II study was slightly amended to include a first choice, "Avoids getting near/in water except to bathe." The Phase III survey contained the following subdivisions; agree-disagree items related to attitudes on swimming (4-point Likert scale), a segment concerning their availability to and quality of a nearby facility, a knowledge and participation in swimming section; and a few basic demographic questions. It took approximately 5-10 minutes to complete the survey, and was read out loud by the survey administrator if the subject needed this service.

Participants

Only adolescent participants' responses were used for this analysis as respondents in the age group could better detail their experiences with learning how to swim (or not) and would respond more precisely regarding other variables associated with swimming (Borgers, Hox & Sikkel, 2003). Further, our panel of aquatic and child

development experts agreed that adolescents, for the most part, are at the age when swimming instruction has been completed. All research participants (n=1428) were recruited using non-swimming YMCA programs at the branch-site or at school settings that used the YMCA for day care/after school care. Under the supervision of a trained YMCA staff member, adolescent subjects (n=600), ages 12-17 years, completed the Phase III research survey on their own with the YMCA employee offering assistance when needed.

Statistical Analysis

Data were analyzed using SPSS v24. Descriptive characteristics of the sample were generated. Swimming instruction type was categorized as formal (certified swim instructor), informal (family or friend), or self-taught. Participants who did not answer the swimming instruction method question were excluded from further analyses. Chi square tests were used to determine differences in swimming instruction by demographic characteristics. ANOVA with least significant difference (LSD) post hoc test was used to determine if there was a significant difference in mean swimming ability scores (1-10) based on swimming instruction type. Swimming instruction type was then further categorized and dichotomized as formal (certified swim instructor) and informal (family, friend, self-taught). Swimming ability was dichotomized as “no-low” or “skilled.” Fear of drowning, knowing how to be safe around water, and enjoyment of swimming were also dichotomized by collapsing the 4-point Likert scale of strongly agree, agree, disagree, and strongly disagree into “agree” and “disagree.” Odds ratios were calculated for these variables based on swimming instruction. Significance was set at a p value of 0.05.

Results

Descriptive characteristics of the sample are reported in Table 1. The mean age of adolescent participants was 14.4 years and more girls than boys completed the survey. Additionally, more of the survey participants were African American and attended schools with free/reduced lunch programs, which was used to determine income levels. Every school year, the US Department of Agriculture (USDA) defines income standards for free and reduced lunch status. For the school year 2016-17 and based on a household size of four (2 parent/caregivers; 2 children), “free” lunch status was designated as \leq \$31,590, and “reduced” lunch status was set at \$31,591-44,955 (USDA, 2016).

Of the 600 adolescent participants, 476 provided an answer to the swimming instruction type question and were included in further analyses. “Formal” instruction represents learning how to swim from a certified instructor, while “informal” instruction involved learning from a family member or friend. Swimming instruction methods by demographic characteristics are provided in

Table 2. There was a significant difference in swimming instruction method based on race/ethnicity and school lunch program. Hispanic/Latino adolescents were more likely to report formal swim instruction while adolescents who qualified for free/reduced lunch programs were less likely to report formal swim instruction.

Table 1. Descriptive Characteristics of the Adolescents, Phase III

Variable	Adolescent (12-17 years) (n, %)
Total Sample	600
Mean age	14.4 years
Sex	
Male	254 (44.3)
Female	320 (55.7)
Race/Ethnicity	
African American	230 (38.3)
White	152 (25.3)
Hispanic	78 (13.0)
Other	140 (23.2)
School Lunch Program	
Free/Reduced Lunch	262 (56.0)
No Lunch Program	206 (44.0)
Parent Education	
Some Elementary/Middle School	105 (20.1)
Some High School	80 (15.3)
High School Diploma/GED	106 (20.3)
College Degree	139 (26.6)
Advanced College Degree	93 (17.8)

Next, ANOVA results revealed that there was a significant difference ($p < 0.01$) in mean swimming ability score based on method of instruction (formal, informal or self-taught). Post hoc analysis showed a significant difference ($p < 0.01$) between adolescents who reported formal swim instruction versus informal swim instruction. Mean swimming ability scores based on method of instruction are listed in Table 3.

Results from Chi square tests (see Table 4) were used to identify differences in “no-low” versus skilled swimming ability, fear of drowning, water safety knowledge, and enjoyment of swimming by instruction type (formal or informal). We found that adolescents who received formal swim instruction were 2.35 times more likely to report being a skilled swimmer (86%) compared to those who received informal instruction (72%). Adolescents who received formal swim instruction were also 1.98 times less likely to indicate that they were afraid of

Table 2. Adolescent Demographic Characteristics and Swimming Instruction Methods – Phase III

Variable	Formal (n, %)	Informal (n, %)	Self-taught (n, %)	Total (n)	Chi square
Total Sample	152 (31.9%)	209 (43.9%)	115 (24.2%)	476	
Sex					0.65
Male	73 (34%)	89 (41%)	54 (25%)	216	
Female	78 (31%)	119 (46%)	59 (23%)	256	
Race/Ethnicity					0.04
African American	48 (29%)	80 (48%)	40 (23%)	168	
White	47 (32%)	71 (49%)	27 (19%)	145	
Hispanic	30 (42%)	22 (31%)	20 (27%)	72	
Other	25 (29%)	35 (40%)	27 (31%)	87	
School Lunch Program					<0.01
Free/Reduced Lunch	35 (23%)	68 (45%)	48 (32%)	151	
No Lunch Program	63 (43%)	58 (40%)	25 (17%)	146	
Parent Education					0.11
Some Elementary/Middle School	25 (29%)	37 (44%)	23 (27%)	85	
Some High School	14 (23%)	25 (42%)	21 (35%)	60	
High School Diploma/GED	35 (38%)	38 (41%)	19 (21%)	92	
College Degree	49 (40%)	51 (41%)	23 (19%)	123	
Advanced College Degree	19 (24%)	40 (50%)	21 (26%)	80	

Table 3. Adolescents’ Swimming Ability by Instruction Type Phase III

Swimming Instruction Type	Mean	N	Std. Deviation	p-value*
Formal	8.11	149	1.59	
Informal	7.37	205	2.21	<0.01
Self-taught	7.75	107	1.95	0.15
Total	7.69	461	1.99	

*compared to self-taught.

drowning (11.8%) compared to those who received informal instruction (21%). We found that there was no significant difference between instruction type and adolescents reporting that they knew how to be safe around water or that they enjoyed swimming.

Table 4. Odds Ratios for Swimming Instruction Type

	Odds Ratio	95% Confidence Interval		Chi Square p-value
Skilled swimmer	2.35	1.35	4.08	<0.01
Fear of drowning	1.98	1.09	3.59	0.02
Knows how to be safe around water	1.60	.83	3.08	0.20
Enjoys swimming	1.59	.83	3.06	0.20

Discussion

To enhance water safety and decrease drowning incidents, swimming instruction from a specially trained and licensed aquatics specialist is highly recommended by child health advocacy groups and public health organizations (AAP, 2010; ARC, 2014; CDC, 2011; Safe Kids USA, 2010). However, there seems to be a lack of research regarding how individuals learn to swim. Study findings highlighted that a formal method of swimming instruction significantly aligned with an elevated swimming ability. We believe that this research is the first to document that learning how to swim from a certified swim instructor leads to an enhanced level of swimming competence. This result supports the consistent recommendations among numerous injury prevention groups to learn how to swim from a certified instructor. Alarming, a large proportion of children, regardless of demographics, are learning how to swim from a family member or friend (43.9%), or indicated they had taught themselves (24.2%). These results are counter to what prevention groups are recommending and may be setting the stage for these children to drown.

Racial and income-related differences were found, which support lower swimming ability for these marginalized groups (Irwin, Irwin, Martin, & Ross, 2010). Results confirmed that 29% African American and 32% White adolescent respondents learned how to swim from a certified instructor, as compared to 42% Hispanic/Latino adolescents who reported they learned to swim from a qualified instructor. Although the Hispanic/Latino participants were the highest racial/ethnic group that formally learned how to swim, we need to remember that 58% did not experience swimming instruction in this manner. Further, findings revealed only

23% of adolescents qualifying for free or reduced lunch programs learned how to swim from a qualified instructor as compared to 43% of adolescents who did not qualify. These distressing results suggest affected groups need support to circumvent drowning events.

Digging deeper into what specifically can result from more formal methods of learning how to swim, we found that not only were respondents more likely to have higher levels of swimming skills, but also have less fear of drowning. Confidence, or self-efficacy, to perform closed skills such as swimming strokes is essential to developing and becoming proficient when executing complex motor skills (Wulf & Lewthwaite, 2016), and thus avoiding hazardous scenarios that could lead to drowning.

Limitations

The most noteworthy limitation involved with this research study limitation was the fact that the results were based on a convenience sample. Research investigators endeavored to create a more balanced or characteristic sample by choosing regionally diverse sites across the US. Also, researchers instructed the YMCA leadership within each city to equitably spread out the number of surveys to at least 3 branches, 1 each representing low-, middle-, and high-income regions in that site. Further, 51.5% of the total sample noted that their yearly household income was \$50,000 or higher, which compares to 53.6% for the total US population for 2016 (US Census Bureau, 2017).

Another research limitation was that we used a secondary source, the YMCAs and their staff, to gather the data. Most YMCA branches have high quality aquatic facilities and programming, and it is generally believed that they do excellent work in this area. Within the survey administration training for the staff, we emphasized that all future survey administrators needed to distribute surveys in non-swimming programming only, such as martial arts, soccer, day care centers, or cooking classes. Conversely, this bias might have been difficult to completely overcome, and thus we believe that the Phase III findings could be considered conservative. It is possible then that skilled swimming skills for all groups were lower than what we found.

Lastly, we diligently strived to amass a large sample of participants, which has been shown to enhance the precision of the results. Nonetheless, there were low numbers of survey responses in some categories. Because of this and other limitations, more research is called for to help enhance swimming skills for all children.

Conclusions

The major finding from this investigation is that the method of how someone learns to swim is significant, and that formal swimming instruction is recommended. Learning how to swim from a certified water safety instructor is important to the level of swimming ability, and to the lack of fear that child will have in the water. Having proficient swimming skills and confidence is key to avoiding the tragedy of drowning.

There are indications that the number of fatal child drowning incidents in the US is decreasing (Bowman, Aitken, Robbins, & Baker, 2012). The CDC reports that in 2015 there were 786 child deaths due to drowning, and this compared to 914 deaths in 2010 and 1,161 fatal drowning incidents in 2000. In contrast, the US Census Bureau (2017) shows the overall population numbers have been increasing for this age group (2000 = 72,293,812; 2010 = 74,181,467; 2015 = 77,828,750). Drowning is still considered a public health issue of great importance, and prevention of any injury-related death is vital.

Free or low cost “learn to swim” programming is recommended specifically for the underserved. It would be prudent for communities with large populations of marginalized youth to ensure their safety by funding swimming lessons as a line item in the city budget or finding donors who have a vested interest in youth sports or physical activity.

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