INTERNATIONAL SEVEN JOURNAL
OF HEALTH RESEARCH
ISSN: 2764-9415

Longitudinal study of the Drowning Prevention Knowledge Level of schoolchildren in Rio de Janeiro, Brazil

Estudo longitudinal do Nível de Conhecimento Preventivo de Afogamento de escolares do Rio de Janeiro, Brasil

DOI: 10.56238/isevjhv3n2-035
Originals received: 04/19/2024
Acceptance for publication: 05/09/2024

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ABSTRACT
Drowning is quick, silent and recognized as a serious public health problem worldwide, but it is neglected. Children and adolescents receive insufficient education about drowning prevention. The objective of this study was to monitor changes in the Drowning Prevention Knowledge Level (DPKL) in elementary school children and adolescents at CAp-UERJ, Rio de Janeiro, Brazil. The methodology was a longitudinal study carried out from 2022 to 2024 with students from the (5th, 6th, 7th, 8th and 9th years) of CAp-UERJ. 12 classes were monitored until 2024, totaling 336 students, four of which were in the 7th year, four in the 8th year and four in the 9th year, with a total of 112 students per year of schooling. A structured questionnaire divided into three parts containing 20 items about DPKL was answered at the school. In the 1st part, students correlated the universal figures used on signs to prevent drowning with the texts that signify those images (7 questions), in the 2nd part they had to relate the colors of the green, yellow and red flags and their meaning in regarding bathing conditions (3 questions) and in the last part, the student marked yes or no on statements related to the correct behavior to be adopted in the aquatic environment (10 questions). Each class received 3 interventions based on the individual DPKL result. When all years of schooling were analyzed together in three moments (2022, 2023 and 2024), the result showed that there was an improvement in knowledge about the 7 prevention signs, to the point that 99.1% of students now knew the meanings of the signs, and in two of them, sign no. 2, which refers to the emergency telephone and in no. 3, pushing prohibited, there was 100% accuracy. It was also possible to verify that after the intervention, almost all (98%) of the students correctly understood the meaning of the colors of the green,

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yellow and red flags. Regarding the behavior of playing nearby or putting their hand in the drain that sucks water from the pool, the result showed that the youngest were the ones who improved the most after intervention, going from 77.2% to 99.1% of those who responded correctly in 2024; about entering the pool, diving with a “somersault”, in a dangerous and inappropriate way, it was found that the older they were, the more aware of the danger caused by headfirst dives. Regarding the DPKL categorization, it was noted that 99% of students were classified as DPKL excellent in 2024. Those in the 8th and 9th years obtained 100% in the classification as DPKL excellent. It can be concluded that the school was a good place to carry out preventive interventions on drowning using an approach focused on behavior change, conceptual identification and student awareness in order to improve DPKL. The diagnostic use of DPKL to monitor school-age students can help identify safety values and concepts in certain regions of the country or specific groups that are not familiar with aquatic environments and thus help to formulate preventive interventions if necessary.

Keywords: Drowning, Water safety, Schoolchildren.

1 INTRODUCTION

Drowning is rapid, silent (WILLIAMS et al., 2023) and recognized as a serious public health problem worldwide (ISIN & PEDEN, 2024) that is neglected, (LI et al., 2023), as the Organization World Health Organization estimates that there are more than 370,000 deaths per year from drowning in the world (WHO, 2022).

Drowning prevention prevents premature mortality (PEDEN et al., 2022) and has the potential to save many more lives than rescuing or treating drowning people (DAVIS et al., 2024). Researchers go further, mentioning that child drownings can and should be reduced with a view to their eventual elimination (VINCENTEN et al., 2023). To do this, it is necessary to anticipate their triggers using a proactive and mainly educational approach (PEIXOTO-PINO et al., 2023a). Education on aquatic prevention should begin in the prenatal period and continue throughout childhood and adulthood (WILLIAMS et al., 2023) with the approach of many actors (PEIXOTO-PINO et al., 2023b) such as, educators (BARCALA-FURELOS et al., 2019).

Evidence shows that educational activities involving children have a positive impact on drowning prevention (XIE et al., 2022). Education campaigns on aquatic prevention in the school environment can help prevent future drowning incidents (ISIN & PEDEN, 2024). The challenge, however, lies in providing cost-effective interventions (for greater accessibility) that are pedagogically efficient and replicable (PEIXOTO-PINO et al., 2023b).

Children receive insufficient education about drowning prevention in swimming lessons and are not achieving essential skills that help prevent drowning (WILLCOX-PIDGEON et al., 2020). In fact, swimming is not universal for “everyone” and it also fails to cover all aspects that

can prevent drowning. At school, it encompasses “all” children globally and in this environment, drowning prevention can be implemented to try to spread attitudes and values that save lives.

The American Report recommends finding ways to incorporate aquatic prevention into the school curriculum (Williams et al., 2023). At school it is possible to access students, who will probably be very receptive to preventive messages (PEIXOTO-PINO et al., 2023). Thus, the school is possibly the most appropriate place to use competence-based teaching, giving the educational process a capacity for practical use of what is taught in theory (KOON et al., 2023) requiring that this content acquire functionality to educate (ZABALA, 2010).

Chinese researchers mention that schools could organize more educational activities and water safety courses, thus improving students' knowledge about drowning prevention, awareness and safety skills (LI et al., 2023).

A competency brings together knowledge, skills and attitudes for its perfect execution (ZABALA, 2010). In motor tasks in water, it is understood that it is not enough to define motor skills, but that this performance occurs based on defined concepts and with appropriate attitudes for their implementation (VASCONCELLOS; MACEDO, 2021).

Therefore, there may be a significant need for increased water safety education for children (DAVEY et al., 2019). This education can come after a diagnostic assessment of the Drowning Prevention Knowledge Level (DPKL) (VASCONCELLOS et al., 2019) so that it is possible to understand the limitations of students that can cause childhood injuries due to drowning, followed by the education of students and their friends (AL-QURASHI et al., 2019).

Water safety awareness classes at school focus on skills development. The concepts, skills and attitudes that enable aquatic skills are approved by the conceptual and procedural pedagogical content and attitudes in drowning prevention (VASCONCELLOS et al., 2023).

In this sense, it is up to the teacher to select educational content and define the concepts, based on the results of the DPKL, that need to be taught so that students do not drown and have preventive awareness (VASCONCELLOS et al., 2023). Then, after defining these concepts, objectives can be determined, content and methodologies can be chosen to consolidate it as a skill to be learned by the student by experiencing them concretely in classes (VASCONCELLOS et al., 2022).

The objective of this study was to monitor changes in the Level of Drowning Prevention Knowledge in elementary school children and adolescents at CAp-UERJ, Rio de Janeiro, Brazil.

2 MATERIALS AND METHODS

This is a longitudinal study carried out from 2022 to 2024 with children and adolescents studying Elementary School (5th, 6th, 7th, 8th and 9th years) at the Instituto de Aplicação Fernando Rodrigues da Silveira (CAp-UERJ) belonging to the State University from Rio de Janeiro. The institution is a component of the public network in the State of Rio de Janeiro, Brazil. In the first semester of 2022, the period in which the study began, 1.140 students participated in CAp-UERJ classes, distributed between the 1st year of Elementary School and the 3rd of High School, totaling 48 classes.

After surveying the number of students per class in each year of schooling, contact was made with the Physical Education teachers at CAp-UERJ who teach classes for the classes to be researched, to whom, once informed about the importance, the objectives and methodology of the study, authorized its completion.

In 2022, 12 classes were selected to monitor the study, distributed among four classes in the 5th year, four classes in the 6th year and four in the 7th year. The classes were selected because they contain, according to Xie et al. (2022), the target audience with the highest risk of drowning due to lower awareness of this risk. Furthermore, in this age group students are able to read, interpret figures, symbols and can be followed longitudinally for enough time to collect data and identify variations in relation to the theme researched during their school career.

The 12 classes were followed until 2024, totaling 336 students in the sample. Namely, in 2024 the study included four classes with a total of 112 students who were in the 7th year, four classes with a total of 112 students who were in the 8th year and four classes with a total of 112 students who were in the 9th year. All children and adolescents aged 9 to 15 who were attending the 5th, 6th and 7th years in 2022, their respective 6th, 7th and 8th years in 2023 and finally the 7th, 8th and 9th years in 2024 were considered eligible.

As an exclusion criterion, having a mental disability to the point of preventing completion of the questionnaire was used. In 2022, 8 students were absent on the research days, 4 students changed schools after the start of the research and 7 had some type of mental disability and therefore did not start the study. In 2023 and 2024, the same students were reassessed, with only 5 losses from the research sample due to students changing schools or not being present during the month of reassessment. In this way, the total number of students monitored in the research, throughout the study, evaluated three times (2022, 2023 and 2024) were 336 CAp-UERJ students.

The research instrument answered by the students was significantly integrated with other Physical Education school content (PEIXOTO-PINO et al., 2023) through the structured questionnaire developed by Vasconcellos et al. (2022), divided into three parts containing 20 items on Drowning Prevention Knowledge Level (DPKL). In the first part, students correlated the universal figures used on signs to prevent drowning with the texts that represent those images (7 questions). In the second part they had to relate the colors of the green, yellow and red flags used on beaches and their meaning in relation to bathing conditions (3 questions). In the last part, the student marked yes or no on statements related to the correct behavior/attitude to be adopted in the aquatic environment, in order to avoid injuries and prevent drowning (10 questions).

Upon receiving the completed questionnaire, the researchers reviewed it for completeness. Data analysis included calculating means for continuous variables and percentages for categorical variables. The DPKL was stratified into five bands, namely, those who scored 0-2 points as having very weak DPKL; 3-4 points as weak; 5-6 points as regular; 7-8 points as good and 9-10 points as excellent DPKL. The result of the DPKL verification was the sum of each correct answer, worth 0.5 points each, obtained in the 20 items researched in the three parts of the questionnaire. The more correct answers the student had, the better their DPKL (VASCONCELLOS et al., 2022). In addition to completing the questionnaire, each class received intervention on drowning prevention.

3 INTERVENTION

As a form of school intervention, in 2022, 2023 and 2024, up to two weeks after the diagnostic assessment on the Level of Drowning Prevention Knowledge, the researchers returned to the school with the individual results of the questionnaire. The students were seated on the court (figure 1) and received their corrected questionnaire with a score from 0 to 10. The researchers read the questionnaire, item by item, to provide the correct answer to the 20 items and also explain the importance of knowing the meaning of each part of the test in relation to prevention.

Figures 1: intervention carried out at CAp UERJ

Each class received three questionnaire feedback interventions (2022, 2023 and 2024) which lasted an average of 40 minutes. During this time, the researchers also allowed students to ask about injury prevention in the aquatic environment.

In the intervention on water safety, the teacher worked on conceptual pedagogical content showing the meaning of the word linked to prevention and its antagonism, such as: prohibited versus permitted; safe versus dangerous; present versus absent; shallow versus deep; clean versus dirty (VASCONCELLOS et al., 2023). Preventive information was taught at school with very basic concepts in a progressive manner and adapted to the age of children and adolescents (PEIXOTO-PINO et al., 2023a).

Other examples were discussed, such as the meaning of the colors shown on the flags that are posted on the beaches to indicate the current degree of danger at sea and the student learning to discern the risk of drowning. Of course, the green flag means a suitable place for swimming; yellow, risk of drowning; red, high risk of drowning and; black, unprotected lifeguard area. In fact, teaching signaling is recommended to prevent drowning (WILLIAMS et al., 2023).

For Vasconcellos et al. (2022) there is also a need to teach the concepts of ditch or rip current to students, with a simple explanation that is appropriate to the age group, and with illustration, above all, explaining that ditch means that in that location there is a movement of water in the towards the open sea and that this is a place where bathers should not stay, as there is a risk of being dragged to the bottom by the strong rip current formed.

The teacher then worked on attitudinal content, with the aim of the student learning to "know how to respect and live together" with norms, postures, values and attitudes, such as, for example, knowing how to respect the rules for using the aquatic environment and the teacher, adopting habits to prevent drowning and, finally, try to internalize something that will last a lifetime. For Stallman et al., (2017) our attitudes affect our behaviors, and it is our real behaviors around aquatic environments that will keep us safe or not; they further add that it is important to instill respect for water from a young age.

Physical education classes are great for working on these rules, discipline, as they already experience, as children, in sport the rules of games, respect for the opponent and, above all, for the referee in terms of accepting his decisions. This intervention is important, as among the factors associated with drowning are: problems arising from a lack of awareness, understanding of the dangers of water and an increase in aquatic risk behaviors (EKANAYAKA et al., 2021).

After the pedagogical intervention with conceptual and attitudinal content, students viewed a banner "vaccinate your pool against drowning" and received an explanatory folder on drowning prevention, material donated by the Brazilian Aquatic Rescue Society (SOBRASA). Each class had two students chosen, one boy (Sheriff Kim) and one girl (Sheriff Tatá) who received a badge (figure 2) to be the prevention sheriff in their class. They were elected by the class after voting on who could be the "guardians" who would help prevent accidents at school.

The class agreed to adopt the gesture of showing an "open hand" as a sign of "stop drowning" as illustrated in figure 3. Using class friends to help in this context of preventing drowning deaths is an example of a strategy that can succeed at school (VASCONCELLOS et al., 2023). In fact, a study by KOON et al., 2023 mentions that friends are a primary motivator in childhood and can contribute to prevention.

Figures 2: sheriffs from the prevention group and figure 3 “stop” drowning group

In the pedagogical intervention, when addressing the conceptual content in relation to what one must know to perform a procedural action, the student learned about how to “know how to do, execute”, such as, for example, the appropriate procedures for entering the water in a shallow place and /or depth, how to swim in a situation of “falling into the rip current”, the differences between swimming in the pool and the sea, how to help someone by providing a floating object instead of diving to try to save and becoming a victim. For Moreland et al. (2022) these interventions can also address the consistent use of life jackets on boats and among swimmers who do not have much aquatic skills in natural waters, as this has the potential to reduce drowning deaths.

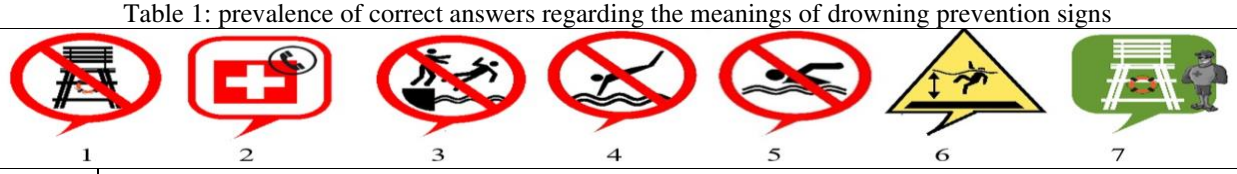
4 RESULTS AND DISCUSSION:

The result of this study showed that there was an improvement in terms of knowing the meaning of the illustrations on drowning prevention signs, to the point where 99.1% of the students now knew the meanings of the signs, and in two of them, sign number 2, which refers to the emergency telephone number and number 3, pushing is prohibited, there was 100% accuracy (Table 1).

Knowing where there is an emergency telephone number (plate 2) can speed up contact with a rescue team. When drowning, every minute of waiting for help makes a big difference to the degree of drowning a person can end up with and consequently increases the risk of death.

Therefore, knowing where you have an emergency phone number and how to use it properly can save a life.

Table 1: prevalence of correct answers regarding the meanings of drowning prevention signs



	Prevalence of correct answers by years and education			
	5º; 6º; 7º years	**6º; 7º; 8º years**	**7º; 8º; 9º years**	**Every year**
*** Plates**	**2022; 2023; 2024**	**2022; 2023; 2024**	**2022; 2023; 2024**	**2022; 2023; 2024**
Plate 1	84,2%; 93,0%;100%	92,0%; 98,2%; 99,1%	99,1%; 100%; 98,2%	91,7%; 97%; 99,1%
Plate 2	98,2%; 100%; 100%	99,1%; 100%; 100%	100%; 100%; 100%	99,1%; 100%; 100%
Plate 3	100%; 98,2%; 100%	99,1%; 100%; 100%	98,2%; 100%; 100%	99,1%; 99,4%; 100%
Plate 4	96,5%; 96,5%;98,2%	98,2%; 99,1%; 100%	97,3%; 100%; 96,4%	97,3%; 98,5%; 98,2%
Plate 5	96,5%; 96,5%;98,2%	99,1%; 99,1%; 100%	97,3%; 100%; 96,4%	97,6%; 98,5%; 98,2%
Plate 6	96,5%; 98,2%;99,1%	98,2%; 100%; 100%	98,2%; 100%; 100%	97,6%; 99,4%; 99,7%
Plate 7	87,7%; 93,0%; 100%	92,9%; 97,3%; 99,1%	97,3%; 100%; 98,2%	92,6%; 96,7%; 99,1%

*legend for plates 1 to 7: plate 1 lifeguard absent; board 2 emergency telephone; sign 3 prohibited pushing; sign 4 prohibited diving; sign 5 no swimming; plate 6 background location and plate 7 lifeguards present.

Regarding sign 1 (absent lifeguard), there was a tendency for an improvement in correct meanings among students in the 7th and 8th years of schooling. Knowing how to recognize this lifeguard sign is important because, according to Moreland et al. (2022) lifeguard supervision around children in or near water is promising for preventing drowning. While its absence can mean a greater risk of death from drowning.

In fact, the “lifeguard” brings with it the meaning of the person who has the responsibility of guarding, protecting, caring for and anticipating risk situations (VASCONCELLOS et al., 2022).

In relation to the regulatory signs, with a diagonal line inside the circle (⃠), as was the case with signs 3, 4 and 5 and indicating that the behaviors of pushing, diving and swimming were prohibited, respectively, the worsening of the 9th year in plates 4 and 5. This finding reinforces the need for constant awareness among students. The symbol chosen to represent the prohibited sign seemed to have been well disseminated among schoolchildren in previous interventions.

When analyzing the prevalences separated by years of schooling, it was noted that 9th year students began to have less assertiveness when it came to respecting the rules, what they could or could not do, as in plates 4 and 5 that mention “diving is prohibited”, which is a conceptual question in relation to what one must know to carry out an attitudinal action, while the 7th and 8th years improved in 2024, starting to report doing fewer risky, wrong or dangerous

activities, perhaps due to the increase in maturity linked to greater age in comparison of when they were in the 5th or 6th year, respective years 2022 and 2023.

Regarding the improvement in the no pushing sign (plate 3) it is a behavioral indication of success in interpersonal relationships, as these students are not ignoring the fact that this behavior presents a risk to another person. On this topic, KOON et al., 2023 mention that in addition to raising awareness about prevention, there must be more programs to motivate interpersonal behavior and promote safe decision-making.

In plate 6 (deep location) there was a tendency for improvement in all years of schooling. The great improvement in the 8th and 9th years is noteworthy, to the point that 100% of these students in these years started to correctly understand the meaning of this plate 6. In fact, the older they are, the greater their ability to interpret texts and answer questionnaires, more practical experiences, more teaching and consequently, more knowledge is gained regarding safe conduct.

Furthermore, plate 7 (lifeguards present) showed an improvement trend in 2024 in the 7th and 8th years, but worsened in the 9th year of schooling. A possible explanation for the drop in prevalence in the 9th year could be inattention when performing the test. However, this group's lack of attention may indicate dangerous behavior in situations of lack of safety and possible drowning.

Without a doubt, the presence of a lifeguard is a protective factor in drowning events (BRAYNE et al., 2022), however, even if it is identified on the sign that a lifeguard is present, it is necessary to help both the professional to identify children who are drowning or involved in activities that increase the risk of drowning as the child identifies the best place to bathe (JOHNSON; LAWON, 2022).

Children who are not familiar with the environment are unaware of the signs, warnings of possible danger and are afraid to ask about the rules for using the place (VASCONCELLOS et al., 2022); Therefore, it is necessary to educate children to ask the lifeguard about the best place to safely enjoy the beach, river, lake, waterfall, swimming pool, as well as to call the lifeguard when they see a drowning situation (PEIXOTO-PINO et al., 2023a).

In all seven plates, the results showed that there was a tendency for a linear increase in the prevalence of correct answers as the year of schooling increased in 2023, however, this did not occur in 2024. There was a declining trend in four plates when analyzing the year 2024 compared to two previous years. This corroborates the idea that intervention in the investigated

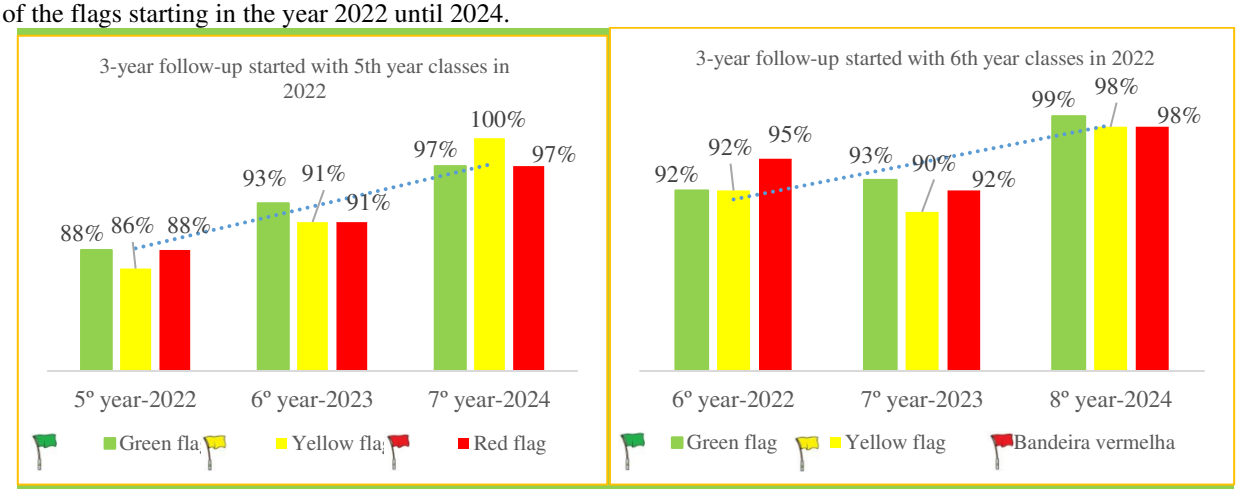
group must be constant to reinforce, especially in older adolescents, preventive behavior and focused attention to understand the real meaning of what they see.

In fact, the probability of death from drowning persists into adolescence and is often attributed to a series of risk behaviors that increase at this stage of life (PEDEN et al., 2024). Behaviors observed, for example, on social media can encourage unsafe activities near water, such as YouTube videos that show jumping from great heights into water (PEDEN et al., 2024). However, when used well, educational videos can help raise awareness to reduce hospital admissions related to drowning (PEDEN et al., 2024).

The result of this study carried out with schoolchildren who responded to the test of conceptual and attitudinal pedagogical content presented in the three colors of the flags (green, yellow and red) as shown in graph 1, in all years of schooling there was a tendency for improvements in 2024 in the correct answers.

When analyzed all the years together, it is possible to verify that after the intervention, almost all (98%) of the students correctly understand the meaning of the colors of the flags. In fact, interventions that teach the real meaning of flags produce improvements in knowledge, such as the finding in the study by Peixoto-Pino et al., (2023a) where approximately half of the children were unaware of the meaning of flags before the intervention, especially the yellow flag. After the intervention, knowledge improved, as all students identified the meaning of the red band and more than 90% recognized the green and yellow band (PEIXOTO-PINO et al., 2023a).

Graph 1: monitoring of classes, for three years, of the prevalence of correct answers about the meaning of the colors of the flags starting in the year 2022 until 2024.



In fact, it is important to teach the symbolism of flags, for example, the yellow flag that indicates "caution", in addition, Woods et al. (2022) mention that some people mistakenly interpret the yellow flag as being private swimming areas. Furthermore, red indicates "stop immediately" and in this context can be used to prevent the movement/use of an aquatic environment (VASCONCELLOS et al., 2022). The green flag means a "cleared" place for swimming, but it is worth emphasizing that no place is completely safe and therefore attention focused on children in the water is very important.

It was also noted that as age/education increased, preventive knowledge also increased in relation to the meaning of the flags. This was demonstrated in the linear growth trend depending on the year of schooling. Therefore, it is important to invest in preventive information for younger people (VASCONCELLOS et al., 2022). Young children represent a particularly vulnerable group due to their limited ability to effectively assess risks and insufficiently developed swimming skills, which impede their autonomy in aquatic environments (PEIXOTO-PINO et al., 2023b).

When comparing all students together at three moments (2022, 2023 and 2024), the results showed a tendency to improve the correct correlation regarding the yellow flag, increasing from 92%, 93% and reaching 98% in prevalence, in relation to the green flag of 91%, 95% and then 98% and also in relation to the red flag, where the prevalence of correct answers improved from 93% to 98% as shown in graph 1.

In a general analysis of this graph 1, although the accuracy rate of the meanings of the flags with their color indicator is high (98%), the red flag, which indicates a high degree of risk of death, does not present, in any of the years, 100 % of success. This indicates the need to continue the intervention to spread knowledge about its meaning. For KOON et al., by 2023 there must be education efforts so that young people behave safely and avoid dangers and risks.

Continuing to teach about the meaning of the red flag is important, as studies have shown that people avoid some places to swim or dive because they associate the red flag with the meaning of dangerous (WOODS et al., 2022).

Although the causes of drowning are numerous and complex, prevention can be achieved through a combination of simple and viable actions (PEDEN et al., 2022). A study by Barcala-Furelos et al., (2019) showed that a simple but well-guided intervention is capable of guaranteeing learning and retention of what was learned in the medium term in children. In this context, interventions that teach the real meaning of flags and signs can help in the fight against drowning.

Teaching symbols that can help with prevention are important in lower schooling, as children learn to interpret symbols before they even learn to read (VASCONCELLOS et al., 2022). According to the World Health Organization, in addition to teaching children basic water safety skills, teachers also need to teach them about the inherent risks, such as water depth, visibility, current, presence of sharp objects, water temperature, dangerous animals and/or microbes (WHO, 2022), as there is a lack of knowledge about how to avoid aquatic incidents (DE OLIVEIRA et al., 2021),

as even the toilet or a bucket of water can cause drowning or death of babies and therefore must always be covered and empty respectively, when there are children nearby (SIDDIQUI; SINGH, 2022). Furthermore, knowing a risk and not preventing it is not an accident, but negligence (CASTILHO, 2024).

This teaching of conceptual content of flags can help prevent drowning by raising student awareness (VASCONCELLOS et al., 2019) so that they are able to apply aquatic skills if they are in a dangerous situation (GUPTA et al., 2019), have emotional control to reason about the best option to follow, know the warning signs, be careful with drains (GUPTA et al., 2019) do not engage in high-risk behaviors in the aquatic environment (LIN et al., 2019) and know how to identify whether you are in good health to swim (ISIN; PEDEN 2022).

In relation to table 2, which dealt with correct behaviors in the pool or swimming class, the results showed that almost all (99.7%) of the students responded that they should play without pushing others from the edge of the pool or into the water. students (question 1). The risk of a child pushed into the pool drowning is reason for this behavior to be seen as inappropriate in the aquatic environment during swimming lessons. Furthermore, children who frequent aquatic environments more frequently may engage in risky behaviors while in the water and are more likely to drown (XIE et al., 2022).

There was a tendency for improvement in relation to question 1 over the years in all schooling levels. In 2024, the prevalence of correct answers regarding the correct behavior of not pushing other students into the water to avoid accidents and/or drowning reached 100% in the 8th and 9th grades.

Regarding the drain (hole) that sucks water from the pool (question 2), the result showed that the youngest were the ones who improved the most after intervention, regarding the risks of putting their hands in the drainage system, over the years when changing from 77.2% to 99.1% in 2024. In fact, children were unaware of the dangers of putting their hand or any part of their body in the suction drain, some did not even know that there was a drain where the water was sucked into the pool .

Namely, the suction drain is a circular opening in the pool where the suction hose connects to the plumbing. If you have turned on the suction, it can suck the part of the body it touches, which could cause serious injury or drowning (VASCONCELLOS et al., 2022).

Vasconcellos et al. (2022) identified that students were unaware of the real danger of being sucked into this drain and causing drowning. This reinforces the importance of investing in preventive information for this younger audience in order to contribute to prevention. Focusing on prevention strategies in this item can help reduce accidents with children sucked in by the vacuum cleaner (VASCONCELLOS et al., 2023).

It is possible that the intervention carried out in the previous year to clarify the dangers that this aspiration site offers may have alerted children to a change in behavior towards this aquatic environment, in a way that has contributed to a better understanding and establishment of the correct attitude towards this suction system.

Regarding questions 3 and 4, the students seem to feel more autonomous and that they do not need to wait for the teacher's authorization to enter the pool or tell them to leave the pool. Apparently this attitude seems to be an attempt to exercise their autonomy, ignoring the risks of this behavior. The 7th year was the group that least mentioned that they needed to ask permission to get out of the water. The 8th and 9th got worse in question 4. In a qualitative analysis carried out post-answers to the questionnaire, the students mentioned that they did not consider it necessary to inform the teacher that they intended to leave or enter the pool.

Constant control of all students is necessary to avoid accidents. Furthermore, the pool is like a classroom, where the student must not leave without the teacher's consent. Leaving without warning can result in the student falling into a deep part of the pool or even into another pool that is not being used and unattended. Entry can only be done when there is supervision.

Even for those who already know how to swim, the ideal is that there is always supervision, because if the person feels unwell, has cramps or has any difficulty that could cause drowning, they can ask for help.

Perhaps this result is due to the fact that they are children and adolescents, as in childhood they begin to have more autonomy and many begin to visit aquatic environments unaccompanied, making it necessary to raise awareness among young people to use these spaces correctly and safely. At this stage of life, identity formation occurs and they absorb many values, habits and ideas from the world around them to shape their personality. KOON et al., 2023, highlight the need for carefully designed education programs that consider and address these changes at this stage of life.

The 7th year had a worsening awareness of avoiding accidents (question 5). It seems that the concept of prevention is still not very clear to this group, as all of them had answered correctly in 2022 (VASCONCELLOS et al., 2023).

The concept of prevention is directly linked to preventing something bad from happening, avoiding harm, harm to those who frequent the place, for example, a slippery area sign, no running around the pool. Conversely, the concept of unprepared is unprepared, who did not take precautions to avoid accidents. For Peden et al. (2022) there must be standardization in communication so that messages can portray safe behaviors. Failure to correctly identify a sign makes the hostile environment less dangerous at first glance, making people ignore danger signs.

Drowning prevention is defined as a multidisciplinary approach that reduces the risk of drowning and builds resilience through implementing evidence-based measures that address hazards, exposures and vulnerabilities to protect an individual, community or population against fatal and non-fatal drownings (SCARR & JAGNOOR, 2024).

Regarding entering the pool by diving in a dangerous and inappropriate way (question 6), the study found that the older they were, they became more aware of the danger caused by diving head first. In the intervention, it was explained to the students how this type of diving can cause a cervical injury and consequently can lead to severe motor disability such as quadriplegia depending on the level of the injury. Diving in shallow waters can cause irreversible consequences. In fact, in all groups there were improvements in the prevalence of 2022-23-24 and the 8th and 9th years stand out, the level of education in which everyone answered correctly.

For Vasconcellos (2022b) it is important not to dive in unknown, shallow, murky waters, places without lighting, not to participate in games when diving and to look for warning signs about the depth of the water before entering. Preventive and educational measures, in particular,

are important in preventing new cases of cervical injuries with severe and permanent motor disability caused by diving accidents.

The improvement in the 7th year and the small worsening in the 8th and 9th years in the prevalence of correct answers about not playing near the bottom drain is noteworthy. Namely, the bottom drain (question 7), also called bottom drain, is one of the devices responsible for suction of water from the pool by the pump and if a person gets close, they can be sucked to the point where their body gets stuck at the bottom of the pool. and even cause death by drowning (VASCONCELLOS et al., 2022).

Cases of great repercussion in the media, about children who were trapped in the bottom drain of the pool, helped to spread the information so that children do not play near the bottom drain. During their answers, the students cited cases seen on social media of children sucked down the drain (VASCONCELLOS et al., 2022). In swimming pools, a malfunction in the pool water drainage system can result in serious injury or even death, especially for healthy children.

Swimming classes can contribute to improving aquatic prevention attitudes when they promote teaching about safe behaviors in different aquatic environments (EKANAYAKA et al., 2021) and when they do not generate a false sense of security, which can put them at risk when they are , for example, swimming in deep places or with currents (WILLIAMS et al., 2023). However, swimming is still underused when the aspect is the prevention of drowning in children (VASCONCELLOS, 2019) where the skills that must be developed are multiple and go beyond the private teaching of individuals in swimming classes. There are a series of skills and competencies that must be mastered before a child has the full capacity to avoid drowning (WILLCOX-PIDGEON et al., 2020).

According to Fonseca-Pinto & Moreno-Murcia (2023), the concept of aquatic competence encompasses three areas of knowledge (knowing how to do, knowing, knowing how to be), in three dimensions (aquatic literacy, drowning prevention and environmental education), where the profile of personal conduct, self-perception of competence and real competence are essential elements for its understanding and development. Therefore, aquatic education must include knowledge, skills and values related to aquatic safety (CASTILHO, 2024).

It is noteworthy that the intervention managed to reverse the worsening of the prevalence of the behavior of entering rough seas (question 10) that the 7th year had. They had decreased in 2023 to 96.5% and managed to improve to 100% accuracy in relation to the correct attitude towards entering rough seas in 2024.

Table 2: prevalence of correct attitudes linked to swimming classes

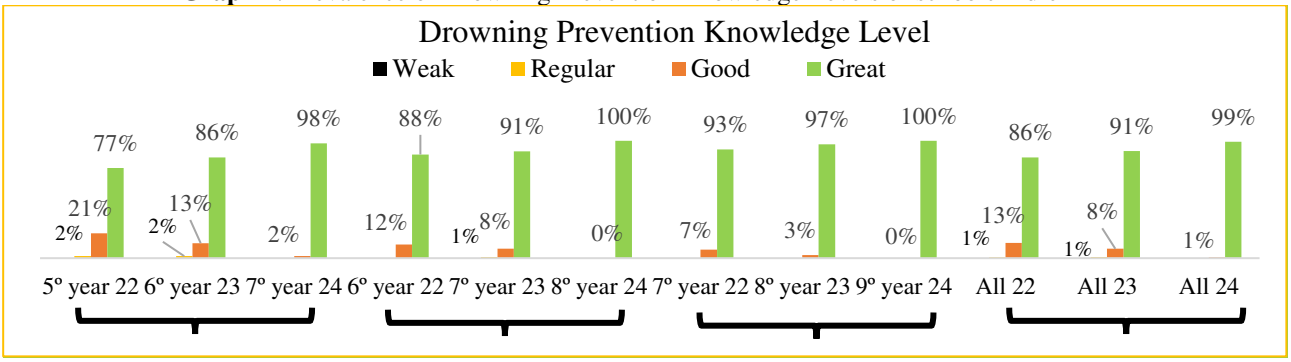
	I must...	Prevalence of correct answers by years and education		
	5º; 6º; 7º years 2022; 2023; 2024	6º ; 7º , 8º years 2022; 2023; 2024	7º ; 8º ; 9º years 2022; 2023; 2024	Every year 2022; 2023; 2024
1.	94,7%; 91,2%; 99,1%	89,9%; 92%;100%	92,9%; 95,5%; 100%	90,5%; 92,9%; 99,7%
2.	77,2%; 86,0%; 99,1%	89,3%; 96,4%; 99,1%	96,4%; 97,3%; 100%	87,6%; 93,2%; 99,4%
3.	100%; 100%; 99,1%	99,1%; 98,2%; 98,2%	99,1%; 100%; 100%	99,4%; 99,4% 99,1%;
4.	91,2%; 78,9%; 95,5%	95,5%; 94,6% ; 93,8%	88,4%; 98,2%; 96,4%	91,7%; 90,5%; 95,2%
5.	100%; 96,5%; 95,5%	97,3%; 98,2%; 100%	99,1%; 100%; 99,1%	98,8%; 98,2%; 98,2%
6.	94,7%; 96,5%; 98,2%	98,2%; 99,1%; 100%	99,1%; 100%; 100%	97,3%; 98,2%; 99,4%
7.	98,2%; 96,5%; 100%	98,2%; 100%; 99,1%	97,3%; 100%; 99,1%	97,9%; 98,8%; 99,4%
8.	98,2%; 94,7%; 100%	97,3%; 97,3%; 99,1%	97,3%; 100%; 100%	97,6%; 97,3%; 99,6%
9.	96,5%; 96,5%; 98,2%	100%; 100%; 100%	99,1%; 100%; 99,1%	98,5%; 98,8%; 99,1%
10.	100%; 96,5%; 100%	99,1%; 98,2%; 100%	98,2%; 100%; 99,1%	99,1%; 98,2%; 99,6%

*Legend for questions 1 to 10 on table x: should I... 1. play pushing the other students into the water?; 2 put your hand in the drain (hole) that sucks water from the pool?; 3 wait for the teacher to call you to enter the pool?; 4. ask or tell the teacher when you are going to leave the pool?; 5 avoid injuries in the pool and value prevention actions?; 6 enter the pool with a somersault jump "somersault"?; 7 play near the bottom drain in the pool?; 8 play races in the wet area around the pool?; 9 try to swim across the river because I take swimming lessons?; 10 enter the rough sea because I take swimming lessons?.

In relation to the Level of Drowning Prevention Knowledge in all years of schooling, the intervention seems to have had an effect and there was a tendency for improvement.

When analyzing all students in comparison in the years 2022, 2023, 2024, an improvement in the Level of Drowning Prevention Knowledge was noted, going from 86% in 2022 with excellent to 99% in 2024 (graph 2). When analyzed separately by year of schooling, the improvement in the 8th and 9th years is notable, as 100% were classified as excellent in the DPKL.

Graph 2: Prevalence of Drowning Prevention Knowledge Levels of schoolchildren



As education increased, the Level of Drowning Prevention Knowledge increased in parallel. The fact that two interventions improve DPKL in schoolchildren demonstrates that prevention can be a good resource to invest in to prevent future drownings. Small actions, when well directed at school, seem to have an impact on improving the level of preventive knowledge. It is necessary to adopt more effective and efficient strategies to prevent drowning in places with

few financial resources (MUGEERE et al., 2022) and which do not have adequate safety regulations (VASCONCELLOS; MASSAUD, 2022).

This study is in line with the drowning prevention proposal made by the General Assembly of the United Nations (UN), which suggested that effective and low-cost interventions be carried out around the world (SCARR et al., 2022). In fact, Leavy et al. (2023) mention that effective interventions contribute to efforts, being an essential first step to face the global challenge of preventing drowning.

It is necessary to teach, in addition to the correct identification of signs and flags, the correct attitudes to be put into practice at a given moment in life, in these scenarios (swimming pools, beaches, rivers, dams and lakes). Having attitudes that value prevention and not recklessness/irresponsibility are virtues for safely enjoying the aquatic environment.

It is expected that post-intervention attitudes will always be prudent, that is, that each student can act with caution, attention, care, without haste, avoid danger and consider the risks.

5 CONCLUSIONS

There were improvements, after the intervention, in the Level of Drowning Prevention Knowledge in all years of schooling investigated, with a linear trend of better performance as the student's year of schooling increased. Students at school are receptive to preventive messages about drowning, which makes the school a conducive and effective place for these actions.

Physical education classes can try to add to their conceptual and attitudinal content, which are already part of the routine, content aimed at preventing drowning.

The diagnostic use of DPKL to monitor school-age students can help identify values and concepts of security in certain regions or specific groups and thus help to formulate interventions if necessary. Students receiving the intervention, their friends and physical education teachers can help create a prevention network that can start at school and continue outside of school.

It is hoped that other schools can also disseminate values of preventive knowledge with students from these and other years of schooling so that the number of deaths from drowning can decrease in the country.

Thanks to professors Izabel Maria da Silva Sobral and Pietro Rodrigues Corrêa who participated in the intervention in 2022-23 and the Brazilian Society of Aquatic Rescue (SOBRASA) for donating banners, umbrellas, blouses, sheriff badges and drowning prevention folders.

REFERENCES

Al-Qurashi, F. O., Yousef, A. A., Aljoudi, A., Alzahrani, S. M., Al-Jawder, N. Y., Al-Ahmar, A. K., Al-Majed, M. S., & Abouollo, H. M. (2019). A review of nonfatal drowning in the pediatric-age group: A 10-year experience at a university hospital in Saudi Arabia. *Pediatric Emergency Care, 35*(11), 782-786.

Atilgan, M., Bulgur-Kirbas, D., Akman, R., & Deveci, C. (2021). Fatal drowning caused by a swimming pool drainage system. *American Journal of Forensic Medicine and Pathology, 42*(3), 275-277.

Barcala-Furelos, R., Carbia-Rodríguez, P., Peixoto-Pino, L., Abelairas-Gómez, C., & Rodríguez-Núñez, A. (2019). Implementation of educational programs to prevent drowning: What can be done in nursery school? *Medicina Intensiva, 43*(3), 180-184.

Brayne, A. B., Jones, W., Lee, A., Chatfield-Ball, C., Kaye, D., Ball, M., Sacher, G., South West Anaesthetic Research Matrix (SWARM), & Morgan, P. (2023). Critical care drowning admissions in Southwest England 2009-2020: A retrospective study. *Journal of the Intensive Care Society, 24*(1), 47-52.

Castillo, M. (2024). A segurança na educação aquática. In R. Fonseca-Pinto, A. Albarracín, & J. A. Moreno-Murcia (Eds.), *Avanços científicos e práticos nas atividades aquáticas* (pp. 49-56). Sb Editorial.

Davey, M., Callinan, S., & Nertney, L. (2019). Identifying risk factors associated with fatal drowning accidents in the pediatric population: A review of international evidence. *Cureus, 11*(11), e6201.

Davis, C. A., Schmidt, A. C., Sempsrott, J. R., Hawkins, S. C., Arastu, A. S., Giesbrecht, G. G., & Cushing, T. A. (2024). Wilderness Medical Society clinical practice guidelines for the treatment and prevention of drowning: 2024 update. *Wilderness & Environmental Medicine, 35*(1_suppl), 94S-111S.

De Oliveira, J., Piñeiro-Pereira, L., Padrón-Cabo, A., Alonso-Calvete, A., García-Crespo, O., Varela-Casal, C., & Queiroga, A. C. (2021). Perception, knowledge and education for drowning prevention in adolescents. *Revista Española de Salud Pública, 95*, e1-19.

Ekanayaka, J., Geok, C. K., Matthews, B., & Dharmaratne, S. D. (2021). Influence of a survival swimming training programme on water safety knowledge, attitudes, and skills: A randomized controlled trial among young adults in Sri Lanka. *International Journal of Environmental Research and Public Health, 18*(21), 11428.

Fonseca-Pinto, R., & Moreno-Murcia, J. A. (2023). Towards a globalised vision of aquatic competence. *International Journal of Aquatic Research and Education, 14*(1), 11.

Gupta, M., Rahman, A., Baset, K., Ivers, R., Zwi, A. B., Hossain, S., Rahman, F., & Jagnoor, J. (2019). Complexity in implementing community drowning reduction programs in southern Bangladesh: A process evaluation protocol. *International Journal of Environmental Research and Public Health, 16*(6), 968.

Işın, A., & Peden, A. E. (2024). The burden, risk factors, and prevention strategies for drowning in Türkiye: A systematic literature review. *BMC Public Health, 24*(1), 528.

Işın, A., & Peden, A. E. (2022). Assessing variations in estimates of drowning mortality in Turkey from 2013 to 2019. *Archives of Public Health, 80*(1), 178.

Johnson, M. B., & Lawson, K. A. (2022). Evaluation of the WAVE Drowning Detection SystemTM for use with children's summer camp groups in swimming pools: A prospective observational study. *International Journal of Critical Illness and Injury Science, 12*(4), 184-189.

Koon, W., Brander, R. W., Alonzo, D., & Peden, A. E. (2023). Lessons learned from co-designing a high school beach safety education program with lifeguards and students. *Health Promotion Journal of Australia, 34*(1), 222-231.

Li, Z., Deng, X., Jin, Y., Duan, L., & Ye, P. (2023). Unintentional drowning mortality among individuals under age 20 - China, 2013-2021. *China CDC Weekly, 5*(47), 1058-1062.

Moreland, B., Ortmann, N., & Clemens, T. (2022). Increased unintentional drowning deaths in 2020 by age, race/ethnicity, sex, and location, United States. *Journal of Safety Research, 82*, 463-468.

Peden, A. E., Williamson, S., Fozard, F., Hanly, M., & Möller, H. (2024). The effect of the 'Swim Reaper' program on water safety awareness, drowning mortality, and morbidity among males aged 15-34 years in Aotearoa, New Zealand. *Journal of Safety Research, 88*, 190-198.

Peden, A. E., Passmore, J., Queiroga, A. C., Sweeney, R., & Jagnoor, J. (2022). Closing the gap for drowning prevention across Europe. *Lancet Public Health, 7*(9), e728-e729.

Peixoto-Pino, L., Barcala-Furelos, R., Lorenzo-Martínez, M., & Rodríguez-Núñez, A. (2023a). Drowning prevention through school health education: Evaluation of the SOS 112 pilot project [Prevención del ahogamiento desde la educación para la salud escolar. Evaluación del proyecto piloto SOS 112.]. *Revista Española de Salud Pública, 97*, e202306057.

Peixoto-Pino, L., Barcala-Furelos, R., Paz-García, B., Varela-Casal, C., Lorenzo-Martínez, M., Gómez-Silva, A., Rico-Díaz, J., & Rodríguez-Núñez, A. (2023b). The "DrownSafe" project: Assessing the feasibility of a puppet show in teaching drowning prevention to children and parents. *Children, 11*(1), 19.

Scarr, J. P., & Jagnoor, J. (2024). Conceptual definition for drowning prevention: A Delphi study. *Injury Prevention, 30*(2), 145-152.

Siddiqui, S. A., & Singh, M. V. (2022). Drowning in home environment: A little recognized mode of fatal injury in Indian infants and toddlers. *Indian Pediatrics, 59*(8), 659.

Stallman, R. K., Moran, K. D., Quan, L., & Langendorfer, S. (2017). From swimming skill to water competence: Towards a more inclusive drowning prevention future. *International Journal of Aquatic Research and Education, 10*(2), 3:1-35.

Vasconcellos, M. B., & Macedo, F. C. (2021). Prevenção do afogamento com uso de conteúdos: Atitudinal, procedimental e conceitual. *Latin American Journal of Development, 3*(6), 3741-3754.

Vasconcellos, M. B., Macedo, F. C., Silva, C. C. C., Blant, G. O., Sobral, I. M. S., & Viana, L. C. A. (2023). Segurança aquática se aprende na escola: Acompanhamento do nível de conhecimento preventivo de afogamento dos escolares do Rio de Janeiro, Brasil. *Revista Brasileira de Medicina de Excelência, 1*(2), 30-55.

Vasconcellos, M. B., & Massaud, M. G. (2022). What is the adequate number of students per class for safety in swimming lessons? Reflection by teachers from Rio de Janeiro, Brazil. *Brazilian Journal of Development, 8*(1), 8047-8062.

Vasconcellos, M. B., Macedo, F. C., Silva, C. C. C., Blant, G. O., Sobral, I. M. S., & Viana, L. C. A. (2022). Segurança aquática: teste de conhecimento preventivo de afogamento usado nas aulas de natação para prevenir o afogamento. *Brazilian Journal of Health Review, 5*(6

), 24304-24324.

Vincenten, J. A., Meddings, D. R., Eardley, K., Sufiur Rahman, M., & White, N. (2023). Advancing child survival: Commitment to act on drowning prevention and opportunity for impactful change. *BMJ Global Health, 8*(12), e014633.

World Health Organization. (2022). *Preventing drowning: Practical guidance for the provision of day-care, basic swimming and water safety skills, and safe rescue and resuscitation training*. Geneva: World Health Organization.

Willcox-Pidgeon, S. M., Franklin, R. C., Leggat, P. A., & Devine, S. (2020). Identifying a gap in drowning prevention: High-risk populations. *Injury Prevention, 26*(3), 279-288.

Willcox-Pidgeon, S., Kool, B., & Moran, K. (2018). Perceptions of the risk of drowning at surf beaches among New Zealand youth. *International Journal of Injury Control and Safety Promotion, 25*(4), 365-371.

Williams, S. R., Dow, E. A., & Johnson, M. B. (2023). Drowning is fast, silent, and preventable: A Texas example of research in action. *Injury Epidemiology, 10*(Suppl 1), 64.

Woods, M., Koon, W., & Brander, R. W. (2022). Identifying risk factors and implications for beach drowning prevention amongst an Australian multicultural community. *PLOS ONE, 17*(1), e0262175.

Xie, X., Li, Z., Xu, H., Peng, D., Yin, L., Meng, R., Wu, W., Ma, W., & Chen, Q. (2022). Non-fatal drowning risk prediction based on stacking ensemble algorithm. *Children, 9*(9), 1383.

Zabala, A., & Arnau, L. (2010). *Como aprender e ensinar competências*. Porto Alegre: Artmed.