Bls training strategy

Estratégia de formação Bls

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ABSTRACT
Cardiovascular diseases are the leading cause of worldwide morbidity and mortality in the adult population, and Cardiopulmonary Resuscitation (CPR) is the typical outcome. Meanwhile, airway obstruction and respiratory diseases prevail in children. Recent studies reveal the importance of training laypeople in Basic Life Support (BLS), but the low economic viability of practical education is notorious, especially in developing countries like Brazil. Thus, a low-cost teaching strategy is necessary. This article aims to demonstrate an intervention strategy in the community for theoretical and practical teaching of BLS, considering social demands, methodology, and expectations of the REVIVA extension project, UFJF. This project aims to train laypeople in clearing the airways and cardiopulmonary resuscitation in Juiz de Fora (Brazil), using mannequins built with reused materials.

Keywords: Basic Life Support, Cardiorespiratory Arrest, Lay People, Strategy, Low Cost.
RESUMO
As doenças cardiovasculares são a principal causa de morbidade e mortalidade mundial na população adulta, e a Ressuscitação Cardiopulmonar (RCP) é o resultado típico. Entretanto, a obstrução das vias aéreas e as doenças respiratórias prevalecem nas crianças. Estudos recentes revelam a importância da formação de leigos em Suporte Básico de Vida (BLS), mas a baixa viabilidade econômica da educação prática é notória, especialmente em países em desenvolvimento como o Brasil. Por conseguinte, é necessária uma estratégia de ensino de baixo custo. Este artigo pretende demonstrar uma estratégia de intervenção na comunidade para o ensino teórico e prático de BLS, considerando as exigências sociais, metodologia, e expectativas do projecto de extensão REVIVA, UFJF. Este projecto visa formar leigos na limpeza das vias aéreas e ressuscitação cardiopulmonar em Juiz de Fora (Brasil), utilizando manequins construídos com materiais reutilizados.

Palavras-Chave: Suporte Básico de Vida, Prisão Cardiorrespiratória, Leigos, Estratégia, Baixo Custo.

1 INTRODUCTION
Cardiovascular diseases (CVD) are the leading cause of death worldwide, emphasizing their occurrence in adults aged 30 and over. An extreme consequence of CVD is acute myocardial infarction (AMI) due to coronary disease, which is the fundamental cause of sudden death (58%) due to cardiorespiratory arrest (CRP). The penetration of a foreign body into a natural orifice, as well as its ingestion or inhalation, has been pointed out by several authors as one of the five main accidents that occur in infants and children under one year old. In addition, it constitutes a potentially fatal accident as it often causes airway obstruction and consequent respiratory arrest (PR), which can evolve to CRP and death.

Several studies assert the presence of a foreign body as a relevant cause of morbidity and mortality among children. About 80% of ACE (foreign body accident) cases occur in children, with a peak incidence between one (1) and five (5) years of age.

To prevent ACE-caused deaths in Brazil, the Brazilian Society of Pediatrics Childhood created the Accident Prevention Committee (1996) and the Convention on the Rights of Children and Adolescents (1990). The latter stated that "all sectors of society, especially parents and children, must be guaranteed knowledge of the basic principles of health and, among others, health care actions, accident prevention, and receive support for the application of this knowledge." However, epidemiological data reveal the lack of efficient law application, proved by the Brazilian Institute of Geography and Statistics
(IBGE), with the information that 2,358 children aged 0 to 14 died in 2015 due to the absence of trained rescuers on the scene.\textsuperscript{16}

In this scenery, after a 10-year-old child died of asphyxiation during a college tour, the bill "Lei Lucas" (PL 9468/2018) became the Ordinary Law 13722/2018, which establishes that "public and private school networks aimed at early childhood and basic education, as well as early childhood education establishments, are obliged to train professionals in their teaching or functional staff in basic first-aid notions."\textsuperscript{17}

There is evidence of mortality reduction in CRP victims who received CPR (cardiopulmonary resuscitation) maneuvers immediately by volunteers, leading to the protection of cardiac and neurological functions.\textsuperscript{18, 19, 20} In a CRP situation, time is a substantial component since, according to the estimates, every minute of CRP equals 10\% less of the probability of survival.\textsuperscript{20, 21} Therefore, the importance of adequate early CPR to avoid fatalities must be emphasized, as the waiting time is directly related to the vitality of the brain and myocardial functions.

Educating laypeople is essential as, in most cases, CRP emergencies occur in places without first responders. According to the American literature, four out of five CRPs happen at home, and victims die before reaching the hospital more than 80\% of the time.\textsuperscript{20, 21} Furthermore, only 1/3 of CRP cases in out-of-hospital settings receive treatment on site.\textsuperscript{20, 21} Such factors can trigger irreversible injuries to vital organs due to a lack of oxygen supply.

The need for adequate education for laypeople in BLS is well known, but some questions remain: How to make theoretical and practical capacitation for the population? And would such a course be economically viable?

2 IMPORTANCE OF ENABLING THE LAY POPULATION IN BLS

Confronting the exposed reality, the knowledge of Basic Life Support (BLS) is of utter importance to laypeople. BLS includes maneuvers performed in out-of-the-hospital environments that, when properly applied, can increase survival rates and reduce the consequences of CRP. BLS consists of the first approach to victims and involves airway clearance, ventilation, and artificial circulation. In addition to recognizing PR and CRP and the correct use of the maneuvers, the BLS also comprehends adequate activation of the emergency medical service due to, for example, early defibrillation in CRP cases originated from cardiovascular diseases.\textsuperscript{20, 21}
Regardless of the professional degree, any individual can intervene positively in a CRP situation as long as there has been consistent capacitation. The simple action of laypeople can prevent brain and myocardial deterioration while the emergency medical service is on its way. There is evidence of the need to teach BLS to laypeople and, on the contrary, of the insufficient existence of such courses\textsuperscript{22, 23, 24, 25}. In this regard, we present the teaching strategy of the extension project of Federal University of Juiz de Fora entitled "REVIVA - basic life support in schools," in which the objective is to capacitate daycare workers in the city of Juiz de Fora (MG, Brazil) in BLS, using individual mannequins made from reused materials, such as PET bottles. The daycare institutions were chosen as the target audience because they tend children from 0 to 4 years old, which is the age group most affected by deaths due to airway obstruction.

3 METHODOLOGY

The base of the extension project is the theoretical and practical training of laypeople in BLS. The theoretical content, which discusses airway clearance, identification of cardiorespiratory arrest (CRP), and cardiopulmonary resuscitation (CPR), is administered through an introductory lecture plus an individual booklet based on the guidelines of the American Heart Association (AHA). Next, students are divided into small groups of five to ten participants and start practicing the maneuvers on reused material, individual and non-transferable, previously made by the group. The course lasts for four hours and occurs according to the availability of the employees of the benefited institutions.

As mentioned, the teaching method counts with the aid of individual mannequins, with prototypes produced by the creators of the project. They meet the needs of both chest compression and ventilation and are hygienic and ideal for individual use. Therefore, they provide biological safety. They have a minimum cost per person as only the following materials are needed for production: three (3) intact PET bottles with their lids, a shirt (T-shirt), 20 centimeters of six (6) mm hose, a 31x13cm plastic bag, scissors, adhesive tape, stapler, thread or string, a 30x30cm cardboard, and pen. Dolls obtained through donations have the purpose of teaching the baby's clearance maneuver.
4 FINANCIAL FEASIBILITY OF THE PRACTICAL BLS COURSE FOR LAYPEOPLE

The hardest challenge in carrying out a practical BLS course, indeed, is the financial viability. Since the usual mannequins cost from US$ 147.15 to US$ 367.87, and individual classes vary from US$ 28.50 to US$ 125.0026. The minimum wage in Brazil in 2020 is equivalent to US$ 192.21 (R$ 1045.00), which makes it difficult for educators to take courses like this.

To reduce the difficulty of accessing BLS courses, we created a mannequin of minimal monetary expense made of reused materials, and which provides biosafety as it is personal and non-transferable. Our objective is to help with the universalization of practical knowledge on the theme in a safe and accessible way. The mannequin's production method is as follows:

1. As previously specified, the making of the lung/rib cage (Figure I) requires a PET bottle, hose, plastic bag, scissors, and adhesive tape.

1.1 The first step consists of sealing all sides of the plastic bag with adhesive tape leaving an entrance for the hose on the regular opening of the plastic bag.

1.2. Insert the hose into the entrance left and then seal the empty plastic bag again.

1.3. Attach the hose-plastic-bag assembly to the top and bottom ends of the PET bottle (this step is crucial to ensure that the bag will empty itself after ventilation). Make sure that the bottle cap and the hose are on the same side.

1.4. Test the lung. To do so, blow into the free opening of the hose. If working correctly, the bag will expand with ventilation and return to the initial (empty) state shortly after. If the plastic bag loosens or does not deflate on its own, make sure to correct its sealing and position, then check again.

Figure I: Representation of the lung/rib cage

2. Mannequin body: as already specified, a shirt, two (2) PET bottles, and a stapler will be necessary to make the mannequin body.
2.1. The first step is to staple the sleeves and the bottom opening of the T-shirt so that they are tightly closed.

2.2. Next, insert two bottles in the shirt through the collar, filling its space and giving it structure.

3. Assembly of the mannequin (Figure II): insert the lung/rib cage through the collar so that it stands in between the two other bottles. The lid of the lung/rib cage remains off of the collar.

3.1. Tie the bottle cap to the collar. Seal it and leave the hose out.

Figure II: Representation of making of the mannequin's body with the rib cage already installed.

Source: Project collection.

4. Mannequin head (Figure III): cardboard, scissors, and a pen will be required, as already specified.

4.1. On the cardboard, contour a head and a neck (at least 10 cm). At the height of where the nose should be, draw two vertical parallel lines of approximately two centimeters, with a distance of two centimeters in between them. At the height of the mouth, draw a circle of a diameter similar to the hose used.

4.2. Cut a strip at least 15 centimeters long and two centimeters wide of cardboard.

4.3. Cut with scissors at the lines that correspond to the nose.

4.4. Fold the 15 cm strip in four and insert it in the vertical cuts making sure that it remains a peak on the head; this is the nose of the mannequin, which can be plugged.

Figure III: Representation of the mannequin head.

Source: Project collection.
5. Finally, fit the head to the body, passing the hose through the hole representing the mouth (Figure IV).

![Figure IV: Finished mannequin.](source: Project collection.)

**BLS CAPACITATION**

There is an initial presentation and an overview of Cardiopulmonary Resuscitation and Airway Clearance. Then, the participants divide themselves into groups of five to ten people, according to the number of monitors available. The monitors are medical students with scholarships and project volunteers, who demonstrate, through practical teaching:

1. Palpation of carotid, femoral and brachial pulses (the latter, for infants);
2. Immobilization of the cervical spine;
3. Turning the victim on their back or side;
4. Airway Clearance: Heimlich maneuver and infant airway clearance maneuver;
5. Cardiopulmonary resuscitation in adults, children, and infants;
6. Finally, the participants try the maneuvers with the monitor's supervision.

In September 2019, the monitors carried out a training in Basic Life Support for 38 employees of two municipal daycare centers in Juiz de Fora - MG: Marcelo Moyses Gaio Municipal Day Care and Hermann Gmeiner Children's School. In the following month, the second training session happened for 17 employees at Creche Municipal Leila de Mello Favero. The most recent activity took place in early 2020, with the training of 100 employees from seven (7) municipal daycare centers in Juiz de Fora.

**5 FINAL CONSIDERATIONS**

Cardiovascular diseases are the first cause of worldwide morbidity and mortality in the adult population, and CRP is the most common outcome. As for children, airway obstruction and respiratory diseases are more prevalent.
Recent studies revealed the importance of training laypeople in BLS, but the low economic viability of practical education is notorious, especially in developing countries, such as Brazil. Thus, a low-cost teaching strategy is necessary.

The development of the mannequin and the REVIVA project have demonstrated the viability of theoretical and practical training of laypeople in an effective and low-cost manner. In addition, they consist of a response to the ordinary Brazilian law 13722/2018, known as Lucas Law, considering the Brazilian social and epidemiological sceneries, with viable production of the material anywhere, given the ease of its making.

The project expects to verify the consolidation of knowledge through the practice of maneuvers during training with the mannequins – which employees can take home – and through the study of a booklet developed by project members and based on the American Heart Association (AHA) guidelines. Furthermore, the project aims to provide trained professionals with safety and the capacity to act in risky situations such as airway obstruction and CRP. At last, REVIVA expects to make the teaching of BLS easier with replication of its methodology.
REFERENCES


