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Evaluation of the Effectiveness of an Anaphylaxis Training Program for Unlicensed Assistive Personnel

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Abstract

This study evaluated a training program designed to prepare unlicensed assistive personnel (UAP) in high school settings to recognize and respond effectively to an anaphylactic emergency. Subjects included 53 adults employed by a high school district in the San Francisco Bay Area of California. A training model was developed based on Bandura's theory of sources of self-efficacy. Knowledge and perceived self-efficacy of participants were measured before and after the training program to determine if a theory-based anaphylaxis recognition and epinephrine auto-injector training program would increase participants' knowledge and self-efficacy in responding to an anaphylactic emergency. Paired *t*-tests revealed significant improvement in scores for both knowledge and perceived self-efficacy following the intervention ($p<.001$). This theory-based training program offers a valuable model for other school nurses in providing knowledge and skill training for UAPs in other health emergencies.

Key Words: anaphylaxis, epinephrine, self-efficacy, school nursing, unlicensed assistive personnel (UAP), training program

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Introduction

Anaphylaxis is a potentially life-threatening medical emergency requiring immediate attention (Dibs & Baker, 1997). The most common cause of anaphylaxis in children who are not in the hospital setting is food allergies with 6-8% of children in the general population affected (Sicherer, Forman, & Noone, 2000). Epinephrine, the appropriate treatment for anaphylaxis, is available in an auto-injector for use in an anaphylactic emergency. The California School Nurse Organization (1999) endorses the administration of epinephrine through auto-injector devices by trained unlicensed assistive personnel (UAP) providing there is direct or indirect supervision by a school nurse. Training similar to that provided for allergic individuals and their families has been recommended for school personnel (Sicherer, et al., 2000). Research is an essential component in identifying the most effective strategies for maximizing the knowledge and confidence of UAPs in responding to school health emergencies and those strategies also need to be theoretically sound. The purpose of this research was to measure the effectiveness of a theory-based anaphylaxis recognition and epinephrine auto-injector training program created for UAPs in the high school setting.

Literature Review

The primary anaphylaxis treatment goal is to prevent fatalities. As early as 1992, researchers demonstrated an association between a delay in treatment and fatal outcomes in schools (Sampson, Mendelson, & Rosen). More recently, researchers and authors have provided valuable recommendations to promote positive outcomes and avoid fatalities. These recommendations include (a) identification of factors which contribute to fatalities (Bock, Munoz-Furlong, & Sampson, 2001), (b) removal of sources of treatment delay (Sicherer, Furlong, DeSimone, &

Sampson, 2001), (c) instruction in proper epinephrine auto-injector use (Sicherer, et al., 2000), and (d) a school readiness plan for food allergy management (American Academy of Allergy, Asthma & Immunology [AAAAI] Board of Directors, 1998; Gaudreau, 2000; Rhim & McMorris, 2001; Sicherer, 2002).

Researchers agree that education in the early recognition of the symptoms of an allergic reaction is of primary importance to help prevent fatal outcomes (Bock, et al., 2001; Sicherer, et al, 2001). The inability of school staff to recognize symptoms and to follow emergency plans is a documented source of treatment delay (Sicherer, et al., 2001). Use of a student health inventory requesting information regarding allergies and severity of response, or simply an annual emergency card requesting significant health information, can help identify students with a documented risk of anaphylaxis. UAP training needs to include personal recognition of students at risk (AAAAI Board of Directors, 1998), location and examination of individual health care plans for the students, and a clear understanding of the school emergency physician-prescribed treatment plan (AAAAI Board of Directors; Bock et al., 2001; National Association of School Nurses [NASN], 2000; Rhim & McMorris, 2001; Sicherer, 2002; Sicherer et al., 2001).

Successful response to an anaphylactic emergency also requires that epinephrine be accessible for use and be stored in a location known to staff. Previous research has shown the availability of epinephrine auto-injector devices to be lacking among adolescents (Bock, et al., 2001; Sicherer, et al., 2000) and in schools (Rhim & McMorris, 2001). One study of fatalities found that only 10% of the victims had epinephrine accessible at the time of their fatal reaction (Bock, et al.). Encouraging affected high school students who have been trained in self-administration of epinephrine to self-carry their medication, with authorization from physician and parent, is one strategy to promote increased accessibility. UAP training can include the identification of self-carrying students and notification of where each individual self-carries (i.e. backpack). Obtaining

an auto-injector for each affected student, and storing it in a location known by staff, will help ensure availability of medication in an anaphylactic emergency.

Several studies recommend training school staff in the administration of epinephrine through use of an auto-injector (Bock, et al., 2001; Rhim & McMorris, 2001; Sicherer, et al, 2000; Sicherer, et al., 2001). This is consistent with the NASN guidelines (2000) which endorse UAP training in prescribed single-dose epinephrine administration under school nurse supervision. Specific training recommendations include demonstration of the correct use of auto-injector training devices and frequent review of administration technique, since repetition of information is associated with successful demonstration of the device (Sicherer, et al., 2000). Additional training in basic first aid and resuscitation is beneficial (AAAAI Board of Directors, 1998; California Education Code, n.d.; Sicherer, 2002).

Theoretical Framework

Based on the body of literature cited, the primary author of this article developed a model to train UAPs to respond successfully in an anaphylactic emergency. Bandura's self-efficacy theory guided the development of this study. Bandura (1994) defines perceived self-efficacy "as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (p. 1). The four main sources of self-efficacy are mastery of experience, social modeling, social persuasion, and reduction of stress reactions (Bandura, 1994). The training model developed for this study was based on three of Bandura's sources of self-efficacy. Social modeling, social persuasion, and mastery of experience guided the development and implementation of the program to train UAPs in the recognition of symptoms of anaphylaxis and EpiPen® (brand name of epinephrine auto-injector) administration (Figure 1).

Social modeling is a source of self-efficacy received by viewing efforts and successes of others (Bandura, 1994). Instructive modeling can also be used in the form of videotape showing the

breakdown of skills required (Bandura, 2000). Use of a video allows the UAP to view causes and symptoms of anaphylaxis and EpiPen® administration. Live demonstration of the administration of epinephrine with a training device provides further modeling. Many affected high school students carry their own medication. Meeting the affected students face-to-face and viewing the location of their self-carried medication provide additional modeling sources.

Social persuasion involves building self-efficacy through realistic, positive, and truthful verbal persuasion targeting the individual's capabilities to master the task (Bandura, 1994). Verbal feedback during skill practice provides information needed to aide in the process of learning skills and appropriate actions (Bandura, 2000). Verbal persuasion is provided through positive verbal feedback during trainee practice with EpiPen® training devices, being careful to avoid criticism by using positive correction if an improper or incorrect action is observed.

Bandura (1994) cites mastery of experience as the most effective source of self-efficacy. One's success in the accomplishment of a task learned or one's success in dealing with an experience in a positive manner resulting in a positive outcome builds belief in efficacy. Mastery of the experience is aided by social modeling and social persuasion and provides the rationale for including hands-on practice with the EpiPen® auto-injector training device. Corrective modeling is a form of feedback that Bandura (2000) cites as the most informative and will achieve the greatest improvement during training. Corrective modeling can be used during skill practice as necessary by calling attention to appropriate technique and making any corrections in a supportive and constructive manner in order to preserve and strengthen efficacy. According to Bandura (2000), many training programs lack the practice needed to achieve proficiency in the modeled skill resulting in a lack of success of using the skill in the environment needed. With proper avoidance of the allergen in the school setting and the majority of the students self-medicating for anaphylaxis at the high school level, it is unlikely that the UAP will ever be required to use the

skill in an actual anaphylactic situation, and yet the UAP needs to be prepared to do so. To ensure proficient use of an EpiPen® if the need does arise, theory supports the repetition of training with skill practice at intervals to achieve the level of practice needed to promote and maintain successful mastery of the skill.

Methodology

Hypothesis

An anaphylaxis recognition and epinephrine auto-injector training program will increase the knowledge and self-efficacy among unlicensed assistive personnel in the high school setting in responding to an anaphylactic emergency.

Research Design and Sample

A pre-experimental design with a pretest and posttest surrounding the training program was used for this study. The intervention was the anaphylaxis recognition and epinephrine auto-injector administration training program. Both knowledge and perceived self-efficacy were measured before and after the training sessions. Permission to conduct this study was obtained from the high school district where it was implemented and from the Institutional Review Board of San Jose State University.

Formal consent to participate in the study was obtained from 53 district employees from seven high schools who attended training sessions and parents of 7 students with a documented risk of anaphylaxis who participated in the training process. Emergency first-responders including principals, assistant principals, deans, campus aides, and health clerks were invited to attend and comprised the majority of the convenience sample. Other trainees included administrative assistants and a school plant manager with two members of her day crew. Subjects included 31 females and 17 males among the 48 participants providing gender information. Age of participants ranged from 25 to 64 years with 10 participants declining to disclose age information. One third of

the subjects related having previous knowledge regarding recognition of the symptoms of anaphylaxis. Subjects relating previous experience with injectable medications also equaled one third but did not include all of the subjects citing possession of previous knowledge.

Intervention: Training Program

The anaphylaxis recognition and epinephrine auto-injector administration training program began with a verbal presentation by the district nurse assisted visually by Power Point slides projected overhead providing the following information: (a) Definition, causes, and symptoms of anaphylaxis, (b) pharmacological action and side effects of epinephrine, (c) directions for use of an EpiPen®, (d) medication location and storage requirements, (e) examination of the district's anaphylaxis care plan, (f) location of completed anaphylaxis care plans for students with a documented risk of anaphylaxis, (g) California Education Code 49414 training standards (n.d.), and (h) a summary of the district's plan for anaphylactic emergency response. A video tape entitled "How to use the EpiPen® Auto-Injector" (Dey, 2002) was presented to provide participants with repetition of information regarding the causes and symptoms of anaphylaxis, actions and side effects of epinephrine, and a visual demonstration of EpiPen® administration.

Following the video, trainees met face-to-face with affected students in attendance, viewed where the students store their self-carried EpiPen®, and viewed the EpiPen® expiration date. Students described their allergic history and answered questions posed by the trainees and district nurse. EpiPen® training devices were distributed for skill practice and used by the district nurse for demonstration. Students and trainees successfully demonstrated EpiPen® administration through use of the training device. The affected students that did not attend the training sessions were identified for trainees by name and picture (when available) after the participating students departed.

Written materials distributed to trainees included a copy of the Power Point presentation and the district's Emergency Health Care Plan for Anaphylaxis. The district created the care plan by combining the Food Allergy Network (2000) Emergency Health Care Plan with a physician's authorization for administration of medication by trained school personnel and for the self-administration of medication by the student. The plan also includes the following: (a) a summary of signs and symptoms of a severe allergic reaction, (b) EpiPen® administration directions, (c) parent and alternate emergency contact phone numbers, (d) names of trained school personnel, (e) space for a student photo, and (f) a site for parental signature indicating agreement with the allergy plan.

Instrumentation

A ten-question multiple-choice test for knowledge was created directly from the information presented in the Power Point presentation. The test received a positive review from six school nurses in the San Francisco Bay Area of California prior to use. Allotting one point for each correct answer, the potential scores ranged from 0 to 10. Unanswered questions were treated as incorrect.

Perceived self-efficacy was measured by using a ten-item self-efficacy questionnaire asking participants to rate their confidence level from 1 to 4 (1 = completely lacking confidence, 2 = somewhat lacking confidence, 3 = somewhat confident, 4 = completely confident) regarding ability to recognize and respond appropriately to an anaphylactic emergency (Figure 2). Using the confidence level as the point score configured scoring. This configuration created a scoring range of 10 (minimum) to 40 (maximum). An unanswered item on either questionnaire required omission of that participant's data from the study of self-efficacy.

Data Collection and Analysis

A total of 12 training sessions were held over a 2-week period at the seven high schools involved. Trainings were held in conference rooms on site where participants were provided with seating and a writing surface.

A consecutively numbered sign-in log was used to document attendance by training program participants. Logs were placed in an envelope with corresponding participant informed consents and transported for storage in a locked file at the district office after each training session. Participant log numbers were noted on each pretest and posttest instrument. Each participant placed completed tests and questionnaires in an individual envelope upon completion. The instrument collection envelopes were transported to a different site from the training log for data analysis to maintain confidentiality and anonymity of participants.

Findings

Table 1 shows a comparison of the pretest and posttest data for both instruments. The paired samples *t*-test was the statistical measure used in this study to analyze data.

Comparison of pretest and posttest scores for knowledge showed significant improvement ($p<0.001$). The mean score of 5.28 (SD = 1.769) at pretest increased to 8.91 (SD = 1.484) after the training intervention (maximum knowledge score = 10). Seventeen percent of the subjects obtained the highest knowledge pretest score of 8 correct. The lowest pretest score was 2 (5.7% of subjects). Subjects scoring 6 or below on the knowledge pretest equaled 75.5% compared to 22.7% scoring 6 or below on the posttest. Knowledge posttest scores above 8 points were obtained by 77.3% of the subjects.

Pre and post perceived self-efficacy questionnaire scores showed significant improvement ($p<0.001$) upon comparison. The pre-questionnaire mean of 20.06 (SD = 7.315) increased to 35.69 (SD = 4.213) after the training intervention (maximum self-efficacy score = 40). Pre-questionnaire

scores ranged from 10 to 37 points. Post-questionnaire scores ranged from 26 to 40 points. Subjects scoring their perceived self-efficacy at 32 points or above increased from 9.5% (pre-intervention) to 79.1% (post-intervention).

These findings support the hypothesis that use of a theory-based anaphylaxis recognition and epinephrine auto-injector training program can increase the knowledge and self-efficacy of unlicensed assistive personnel for responding to an anaphylactic emergency.

Limitations

The limitations of this study include the lack of a control group and the use of two new or revised instruments for data collection. The knowledge test was created specifically for the training program and underwent peer review before being used for the first time in this study. The self-efficacy questionnaire, although based on typical 10-item self-efficacy measures, was also used for the first time in this study. Use of a convenience sample also prevents generalization beyond the specific population involved in this study.

Implications for School Nursing Research and Practice

As funding for school nurse services decline and school nurses are required to serve large student populations at multiple school sites, nurses must delegate some responsibilities to unlicensed personnel at each school site. Training UAPs to be skilled to perform tasks and to feel comfortable in accepting responsibilities beyond the scope of their job description is a challenge. Lack of knowledge related to emergency health events and lack of confidence in one's ability to respond can jeopardize student safety. The significant improvement in knowledge and perceived self-efficacy scores following the implementation of this training program suggests that theory-based training programs can be effective in addressing both knowledge and self-efficacy.

Future researchers may find it valuable to adapt the training model developed for this study for use with other symptom recognition and skill training programs. Figure 3 provides a diagram of a

generalized model for skill training based on Bandura's sources of self-efficacy for use in school nursing practice. Recognition of the symptoms of hypoglycemia and hyperglycemia with skill training for the implementation of blood glucose monitoring, or seizure recognition with skill training for the implementation of the administration of Diastat®, are two examples of possible applications of this model. In addition, evaluation of long-term retention of both knowledge and self-efficacy would be useful in determining the frequency of training and skill practice necessary to maintain participants' confidence in both knowledge and skills.

One of the unexpected benefits of this district wide training was the opportunity it provided for the school nurse to interface more widely with school personnel. District wide training provides an opportunity for increased nurse visibility and interaction with both school administrators and staff. Another benefit of this research relates to the level of confidence school nurses may feel when delegating emergency responsibilities to unlicensed personnel (Kelly, McCarthy, & Mordhorst, 2003). The strongly positive outcomes of this study suggest that with theoretically sound educational strategies, selected emergency responsibilities can be effectively delegated to UAPs.

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Figure Captions

Figure 1

Diagram of Anaphylaxis Recognition and Epi-pen® Administration

Training Model Based on Bandura's Sources of Self-Efficacy

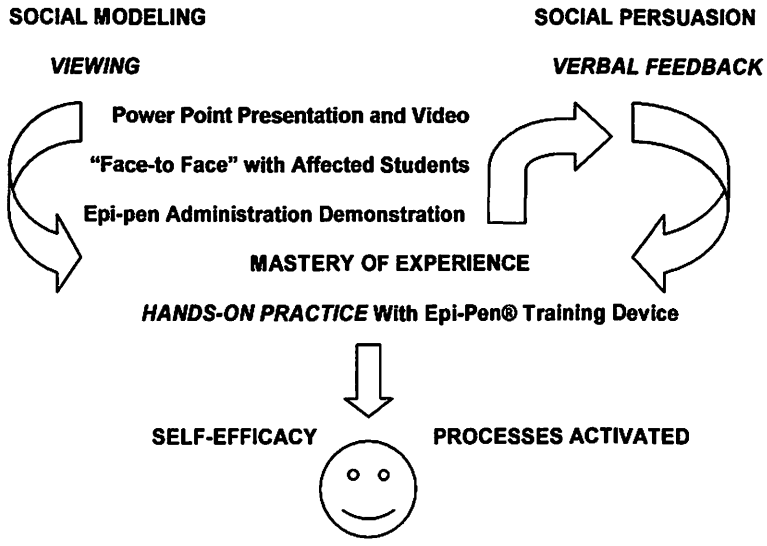

Figure 2

Number: _____ **Date:**_____

Anaphylaxis Management Self-Efficacy Questionnaire for Unlicensed Assistive Personnel

Please circle the most appropriate response for each item below using the following scale:

Completely	***Somewhat***	***Somewhat***	***Very***
1 = *lacking* confidence	**2 = *lacking* confidence**	**3 = confident**	**4 = confident**

Please do not leave any item blank.

A. How confident are you that:

1.	You know the initial actions to take in the event of an anaphylactic reaction occurring at school?	1	2	3	4
2.	You can identify students at your school with a documented risk of anaphylaxis?	1	2	3	4
3.	You can locate the anaphylaxis emergency care plan for an affected student?	1	2	3	4
4.	You know the steps to take to prepare an auto-injector device for use and locate the correct site for administration of the medication?	1	2	3	4
5.	You know the correct actions to take following the administration of medication for anaphylaxis?	1	2	3	4

B. How confident are you in your ability to:

6.	Recognize an anaphylactic emergency?	1	2	3	4
7.	Locate the medication needed to treat a student with a documented risk of anaphylaxis?	1	2	3	4
8.	Demonstrate the correct technique of administration of medication with an auto-injector device?	1	2	3	4
9.	Recognize the effects of epinephrine used in the treatment of anaphylaxis?	1	2	3	4
10.	Know when to call 911 in the event of an anaphylactic emergency?	1	2	3	4

Table 1.

Anaphylaxis Recognition and Epi-pen® Administration Training Program Effects

Instrument	Mean (SD)	*n*	*df*	*t*	*p*
Pretest knowledge	5.28 (1.769)	53			
Posttest knowledge	8.91 (1.484)	53			
Difference between pre & posttest scores			52	-14.568	.000*
Pre self-efficacy	20.06 (7.315)	52			
Post self-efficacy	35.69 (4.213)	52			
Difference between pre & post questionnaire scores			51	-16.602	.000*

Note. Paired *t*-tests were used for comparisons.
*$p < .001$, two-tailed

Figure 3

Diagram of UAP Skill Training Model

Based on Bandura's Sources of Self-Efficacy

for use in School Nursing Practice