

# Pediatric Advanced Life Support (PALS) Courses in Israel: Ten Years of Experience

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## Abstract

**Background:** The Pediatric Advanced Life Support course of the American Heart Association /American Academy of Pediatrics was established in Israel in 1994 and has since been presented to over 3,108 medical and paramedical personnel.

**Objectives:** To assess the achievements of participants in the PALS course, as a cohort and by professional group, and their evaluations of different aspects of the course; and to describe the educational modifications introduced to the course since its introduction in Israel based on our teaching experience.

**Methods:** The study sample consisted of physicians, nurses and paramedics from all areas of Israel who registered for PALS between January 2001 and December 2003. Participants took a standardized test before and after the course; a score of 80 or higher was considered a pass. On completion of the course, participants were requested to complete a 24-item questionnaire evaluating the quality of the course as a whole, as well as the lectures, skill stations, and instructors' performance. Items were rated on a 5-point scale. Results were analyzed using the BMPD statistical package.

**Results:** Altogether, 739 subjects participated in 28 courses: 13 attending (in-hospital) physicians (1.8%), 89 community pediatricians (12%), 124 residents (16.8%), 304 nurses (41.1%), and 209 paramedics (28.3%). About half (48.9%) were hospital-based, and about half (47.9%) had no experience in emergency medicine. A passing grade was achieved by 89.4% of the participants; the mean grade for the whole sample was 87.2%. The mean test score of the residents was significantly better than that of the nurses ( $P < 0.05$ ) and pediatricians ( $P < 0.01$ ). The median evaluation score for four of the five stations was 5, and the mean overall score for all items was 4.56 (range by item 3.93–4.78).

**Conclusions:** PALS was successfully delivered to a large number of healthcare providers in various professional groups with very good overall achievements and high participant satisfaction. It significantly increased participants' knowledge of pediatric resuscitation. We therefore recommend the PALS course as an educational tool in Israel.

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Pediatric Advanced Life Support is a 2 day course designed to impart the knowledge and practical skills needed for a team-based approach to the resuscitation of critically ill and injured children [1,2]. It was developed by the American Heart Association and the American Academy of Pediatrics in the late 1980s. Since then there has been an exponential increase in participation by a variety of healthcare providers in the United States

[3,4] and worldwide [5]. Major revisions of the program were made in 1994, 1997 [6] and 2000 [7].

PALS was introduced into Israel in November 1994 by the Schneider Children's Medical Center of Israel in collaboration with the Israel Association for Emergency Medicine. In March 1999, its organization was taken over by Tel Aviv University. To date, PALS has been offered at the Schneider Children's Medical Center–Tel Aviv University Training Center to over 3,108 medical and paramedical personnel in 117 courses. In 2004, five additional medical centers around the country (Rambam, Wolfson, Nahariya, Soroka, and Sourasky) were accredited as PALS training sites by the Scientific Council of the Israel Medical Association.

The objectives of the present report were twofold. In a quantitative study, we assessed the achievements of professionals who attended the course and their evaluations of different aspects of the course. In addition, we sought to describe the methodologic changes introduced to the PALS course in Israel to improve its quality and efficiency as an educational tool on the basis of our long-term experience.

## Subjects and Methods

### Course material

The standard AHA/AAP 2 day PALS course is offered in Israel [1,2,7]. The program includes didactic lectures, interactive case presentations, hands-on skill stations, case simulation stations, and written pre- and post-course tests as described in previous and current (2002) versions of respective instructor's books [1,7]. The standard PALS textbook in English was used until an authorized Hebrew translation became available in January 1997 [8]. All lectures are given in Hebrew using official PALS slides in English.

### Course participants

Initially, participation in PALS by hospital and community physicians was voluntary; residents and nurses were encouraged (but not required) to participate by hospital administrations, and paramedics were obligated to participate. In 2003, the Israel Ministry of Health passed legislation to make PALS courses mandatory for resident physicians in pediatrics and emergency.

The sample included in the present study consisted of physi-

PALS = Pediatric Advanced Life Support

AHA = American Heart Association

AAP = American Academy of Pediatrics

cians, nurses and paramedics from all parts of the country who attended the 28 PALS courses offered between March 2001 and December 2003, before it was made mandatory for pediatric and emergency medicine residents. In most of the courses, participants from the different disciplines were grouped together; only a few courses were targeted to a specific professional discipline, such as paramedics.

### Testing

According to the present protocol, a pretest is administered immediately after registration on day 1, and a post-test at the end of the course on day 2. The pretest comprises 15 questions selected from the original standardized 50-item AHA test [9] (time constraints preclude the use of the entire test), and the post-test comprises all 50 items of a different version of the AHA test, as explained in our previous study [9]. Both are administered in Hebrew. A score of 80% on the post-test is considered a pass, according to AHA guidelines [1].

### Course evaluation by participants

At the end of each course a feedback discussion is conducted with the participants and evaluation forms are distributed. The forms used in the present study included, for the first time, questions on the responder's profession and background, followed by a series of items on the quality of the course, divided into three parts: seven items on satisfaction with the course aims and content, the correlation between the course aims and content, and the relationship between the course material and the cognitive and hands-on skills; seven items on the quality of the lectures with regard to content and lecturer; and seven items on the quality of the skill and evaluation stations with regard to content and instructor. Each item was rated on a 5-point scale from 1 (low) to 5 (high). We computed the number and percentage of participants who responded to each item, the mean and median evaluation scores for the whole course and for each station, lecture and instructors/lecturers, and differences in evaluations by professional group.

### Statistical analysis

Statistical analyses were performed with the BMPD statistical package [10]. Chi-square analysis with Yates' correction was used to compare proportions between groups (such as proportion of participants who passed the test). Kruskal-Wallis test with multiple comparisons was used for analysis of non-parametric data. All confidence intervals were 95% and on the  $\Delta(\mu)$  between the two groups. *P* values of less than 0.05 were considered significant. Percentages did not add up to 100% because of truncating.

### Results

A total of 739 healthcare providers participated in the 28 PALS courses administered during the study period, accounting for 23.8% of all PALS participants in Israel since the course was introduced. The number of participants per course ranged between 17 and 40, with an average of 26 and a median of 25.

The distribution of the course participants by profession is shown in Figure 1. Almost half (47.9%) had no experience in emergency medicine, 8.2% had 1 year experience, and 23.7% had up to 5 years experience. The distribution of course participants by work place is shown in Figure 2.

### Post-test outcome

The proportion of participants who passed the post-test (whole sample and by profession), and the mean grades are shown in Table 1. The mean test score of the residents was significantly better than that of the nurses ( $P < 0.05$ ) and pediatricians ( $P < 0.01$ ).

### Course evaluation outcome

All 739 course participants returned the questionnaire. Each item received an average of 454 responses (61%). The median score for four of the five stations was 5, and for the animal laboratory station 4. The mean overall score was 4.56, with a range by item of 3.93 for the quality of the animal laboratory station to 4.78 for the instruction at the vascular access station.

Significant differences in ranking among the professional groups were found for four items: a) The quality of the integration of the theoretical and skills components of the course was ranked higher by paramedics than nurses, and higher by nurses than physicians ( $P = 0.0038$ ). b) Satisfaction with the course organization and pace was significantly different ( $P =$

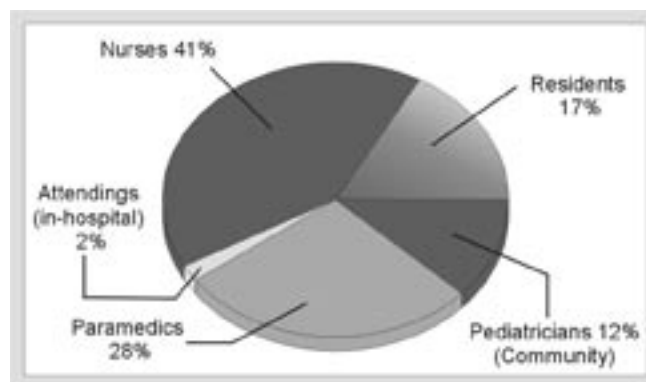


Figure 1. Percentage of PALS course participants by profession

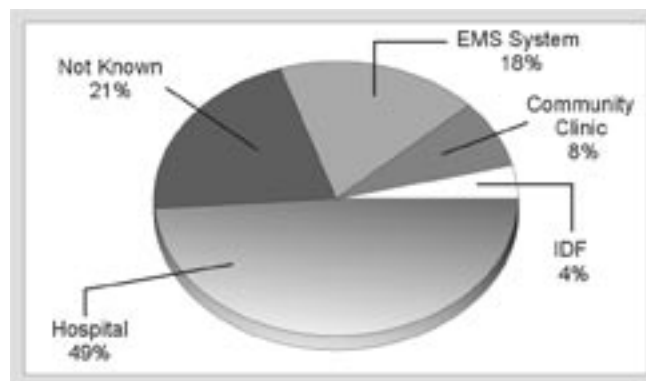


Figure 2. Percentage of PALS course participants by workplace. IDF = Israel Defense Force.

**Table 1.** Proportion of participants passing the post-test, and post-test scores by professional group

Group	N (%)	Proportion passing test	P	Mean post-test score $\pm$ SE	P*
Total	739 (100)	89.4	<0.025#	87.2 $\pm$ 0.3	
Attending physicians (in-hospital)	13 (1.8)	92.3		87.3 $\pm$ 1.8	
Pediatricians (community)	89 (12)	87.6		85.9 $\pm$ 0.8	< 0.01**
Residents	124 (16.8)	94.4		89.3 $\pm$ 0.6	< 0.05***
Nurses	304 (41.1)	85.4		86.7 $\pm$ 0.5	
Paramedics	209 (28.3)	92.8		87.3 $\pm$ 0.4	

# P value of comparison of proportions between all groups. Significance due to high number of failures among nurses compared to number of failures among residents and paramedics.

\* One-way ANOVA with Bonferroni correction.

\*\* Mean scores between pediatricians and residents

\*\*\* Mean scores between residents and nurses

0.0117) among the following groups, from high to low: pediatricians, paramedics, residents, nurses, and attending physicians. c) The lecture on neonatal resuscitation was ranked significantly higher by nurses and paramedics than by residents and pediatricians ( $P = 0.0093$ ). d) The integration session on stabilization and transport was ranked highest by nurses, followed by pediatricians, residents, paramedics, and attending physicians ( $P = 0.0309$ ).

## Discussion

Since its development and widespread implementation, the PALS program has had an enormous impact on pediatric resuscitation education and patient treatment, in the USA and worldwide [1–4] – improving caregivers' knowledge [11,12], technical skills [11–13], confidence, and performance [14]. The present study and our previous experience [9] show many similar findings in Israel. Although improvement in actual patient outcome has been difficult to ascertain [3], there is a general physician impression of benefit.

In Israel, PALS has been delivered to a large number ( $n = 3,108$ ) and variety of healthcare providers. This achievement was made possible by having a team of instructors from the USA train the first Israeli group of 20 participants to be instructors themselves. With the growing need for PALS courses (at least one per month at our site), other PALS instructors' courses were added yearly (one per year) between 2000 and 2004.

The present study was performed after several changes had been gradually introduced to the PALS course in Israel, based on our ongoing analyses of test achievements, specific comments of the participants, accumulation of educational experience, and AHA guidelines. The changes are as follows:

- *Translation of the PALS textbook into Hebrew to eliminate the language barrier.* This was based on results of our earlier study on PALS [9].
- *Written test prior to course delivery to improve preparedness.* This practice was adopted from our experience with the Advanced

Trauma Life Support [15]. Subsequently, pretests were also incorporated into the AHA version of the course.

- *Design of structured skill and evaluation stations.* To minimize inter-instructor variability in station performance and to keep educational standards high, we introduced innovative educational tools based on adult learning principles [4,16], under the guidance of medical educators from Tel Aviv University.
- *Design of a course and faculty evaluation form.* As shown in the present study this practice provides important feedback for improving course quality and participant satisfaction.
- *Improvement of educational methodology emphasizing principles of adult education* [4,16]. This too was done with the help of medical educators from Tel Aviv University.

These strategies were designed to foster positive interactions between instructor and students, taking student motivation for participating in the course into consideration. Demonstrations in skill stations and structured teaching paradigms were incorporated into the PALS instructor courses, and flexibility in case scenarios based on the learners' background and experience was applied.

In the present study, the achievement of the professional groups was very high, with 89.4% of participants passing the post-test with a mean score of 87.2%. Owing to the paucity of reports on PALS performance in the USA, it is difficult to compare rates between the two countries. Nevertheless, in the study by Nadel et al. [11] of a pediatric training program at a large tertiary care children's hospital in the USA, postgraduate year 3 level residents achieved an average score of  $93.2 \pm 5.5\%$  on the standardized PALS test compared to  $89.3 \pm 0.6\%$  for the residents in our study. This small difference may be at least partly explained by the fact that most residents in Israel take the PALS course during their first year, whereas those in the study of Nadel et al. [11] were in their third year and therefore more experienced.

The level of performance in our courses compares favorably with PALS results in Taiwan (mean score 86.8%) [12] and Spain (mean score 90.5%) [14], and to another advanced life support course, the ATLS, offered in Israel (77% passing) [15]. The course participants gave the course a high grade (mean 4.56 out of a maximum of 5) and were satisfied with the course content and quality of the lectures and instructors. The lowest mean score (3.93) was given for the animal laboratory station where anesthetized cats were used to teach intubation of young infants. The feedback discussion held at the completion of the courses indicated a high emotional and ideological opposition by many of the participants to the use of household animals for medical education purposes. We assume this attitude contributed to the low evaluation score. This station was later eliminated from the program because it was removed from

ATLS = Advanced Trauma Life Support

the requirements of the AHA and because of the development of new airway manikins.

There were significant differences among the professional groups in four items of the course evaluation. These, like the differences in achievements in this and our earlier study [9], may reflect differences in background knowledge, in roles in the process of resuscitation, and in needs and expectations from the course. Together, these findings suggest that instead of delivering the same course to all participants, regardless of background and profession, we might do well to tailor parts of it to specific professional groups, as offered by the AHA and AAP in the new version (2002) of PALS. The participation of attending physicians and pediatricians, who usually serve as role models and mentors for students and residents, was poor, with these groups accounting for only 1.8% and 12%, respectively, of all those who took part in the course. This might be explained by the higher participation of attending physicians, including heads of departments, in the early courses shortly after the PALS program was started in Israel.

## Conclusions

This study shows very good overall achievement and a high level of satisfaction by a large number of healthcare providers of various professional groups who attended the standard AHA/AAP PALS course in Israel. These findings agree with our previous work showing that PALS significantly increases knowledge of pediatric resuscitation. We therefore recommend its use as an educational tool for resuscitation programs for all health providers who care for children. Further studies are required to determine the effect of PALS on actual performance and outcome of resuscitation.

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## References

- Chameides L, Hazinski MF. Textbook of Pediatric Advanced Life Support. Dallas, TX: American Heart Association, 1994.
- Chameides L, Hazinski MF. Textbook of Pediatric Advanced Life Support. Dallas, TX: American Heart Association, 1997-1999.
- Jabbour M, Osmond MH, Klassen TP. Life support courses: are they effective? *Ann Emerg Med* 1996;28:690-8.
- Seidel JS, Henderson DP, Spencer PE. Education in pediatric basic and advanced life support. *Ann Emerg Med* 1993;22:489-94.
- Chameides L. Resuscitation: a historical overview. *Pediatric Life Support International Newsletter*, Jan-Feb-Mar 1997.
- Bardella JJ. Pediatric advanced life support: a review of the AHA recommendations. American Heart Association. *Am Fam Physician* 1999;60(6):1743-50.
- Hazinski MF, Zaritsky AL, Nadkarni VM, Hickey RW, Schnayder SM, Berg RA. PALS Provider Manual. Dallas, TX: American Heart Association, 2002.
- Waisman Y, Sivan Y. Pediatric Life Support – Basic and Advanced. Tel Aviv: Tel Aviv University Press, 1997.
- Waisman Y, Amir A, Mimouni M. Pediatric Advanced Life Support (PALS) course improves knowledge of pediatric resuscitation. *Pediatr Emerg Care* 2002;18:168-70.
- BMPD Statistical Software. Dixon WJ, ed. University of California Press, 1992.
- Nadel FM, Lavelle JM, Fein JM, et al. Assessing pediatric senior residents' training in resuscitation: fund of knowledge, technical skills, and perception of confidence. *Pediatr Emerg Care* 2000;16(2):73-6.
- Lin JJ, Chi CS, Shu SG. The preliminary result of the training course of pediatric advanced life support. *Acta Paediatr Taiwan* 1999;40(1):5-8.
- Quan L, Shugerman RP, Kunkel NC, Brownlee CJ. Evaluation of resuscitation skills in new residents before and after pediatric advanced life support course. *Pediatrics* 2001;108(6):E110.
- Carrillo AA, Lopez HC, Moral TR, et al. Evaluation of basic and advanced pediatric resuscitation courses. *An Esp Pediatr* 2000;53(2):125-34.
- Blumenfeld A, Ben Abraham R, Stein M, et al. The accumulated experience of the ATLS program in Israel. *J Am Coll Surg* 1997;185:8-12.
- Billi JE, Membrino GE. Education in adult advanced cardiac life support training programs: changing the paradigm. *Ann Emerg Med* 1993;22:475-83.

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