# ABSTRACTS FROM CURRENT LITERATURE

## A mobile device application to reduce medication errors and time to drug delivery during simulated paediatric cardiopulmonary resuscitation: a multicentre, randomised, controlled, crossover trial

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**Background:** Vasoactive drug preparation for continuous infusion in children is both complex and time consuming and places the paediatric population at higher risk than adults for medication errors. We developed a mobile device application (app) as a step-by-step guide for the preparation to delivery of drugs requiring continuous infusion. The app has been previously tested during simulation-based resuscitations in a previous single-centre trial. In this trial, our aim was to assess this app in various hospital settings.

**Methods:** We did a prospective, multicentre, randomised, controlled, crossover trial to compare this app with an internationally used drug-infusion-rates table for the preparation of continuous drug infusion during standardised, simulation-based, paediatric post-cardiac arrest scenarios using a high-fidelity manikin. The scenarios were split into two study periods to assess the two preparation methods consecutively, separated by a washout distraction manoeuvre. Nurses in six paediatric emergency centres in Switzerland were randomly assigned (1:1) to start the scenario with either the app or the infusion-rates table and then complete the scenario using the other preparation method. The primary endpoint was the proportion of participants committing a medication error, which was defined as a deviation from the correct weight dose of more than 10%, miscalculation of the infusion rate, misprogramming of the infusion pump, or the inability to calculate drug dosage without calculation and guidance help from the study team. The medication error proportions observed with both preparation methods were compared by pooling both study periods, with paired data analysed using the unconditional exact McNemar test for dependent groups with a two-sided á level of 0·05. We did sensitivity analyses to investigate the carryover effect. This trial is registered with ClinicalTrials.gov, number NCT03021122.

**Findings:** From March 1 to Dec 31, 2017, we randomly assigned 128 nurses to start the scenario using the app (n=64) or the infusion-rates table (n=64). Among the 128 drug preparations associated with each of the two methods, 96 (75%, 95% CI 67–82) delivered using the infusion-rates table were associated with medication errors compared with nine (7%, 3–13) delivered using the mobile app. Medication errors were reduced by 68% (95% CI 59–76%; p<0·0001) with the app compared with the table, as was the mean time to drug preparation (difference 148·2 s [95% CI 124·2–172·1], a 45% reduction; p<0·0001) and mean time to drug delivery (168·5 s [146·1–190·8], a 40% reduction; p<0·0001). Hospital size and nurses' experience did not modify the intervention effect. We detected no carryover effect.

**Interpretation:** Critically ill children are particularly vulnerable to medication errors. A mobile app designed to help paediatric drug preparation during resuscitation with the aim to significantly reduce the occurrence of medication errors, drug preparation time, and delivery time could have the potential to change paediatric clinical practice in the area of emergency medicine.

## Association between Policy Changes for Oxygen Saturation Alarm Settings and Neonatal Morbidity and Mortality in Infants Born Very Preterm

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**Objective:** To determine the impact of policy changes for pulse oximetry oxygen saturation ($SpO_2$) alarm limits on neonatal mortality and morbidity among infants born very preterm.

**Study design:** This was a retrospective cohort study of infants born very preterm in the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Neonatal Research Network. Infants were classified based on treatment at a hospital with an $SpO_2$ alarm policy change and study epoch (before vs after policy change). We used a generalized linear mixed model to determine the effect of hospital group and epoch on the primary outcomes of mortality and severe retinopathy of prematurity (ROP) and secondary outcomes of necrotizing enterocolitis, bronchopulmonary dysplasia, and any ROP.

**Results:** There were 3809 infants in 10 hospitals with an $SpO_2$ alarm policy change and 3685 infants in 9 hospitals without a policy change. The nature of most policy changes was to narrow the $SpO_2$ alarm settings. Mortality was lower in hospitals without a policy change (aOR 0.63; 95% CI 0.50-0.80) but did not differ between epochs in policy change hospitals. The odds of bronchopulmonary dysplasia were greater for hospitals with a policy change (aOR 1.65; 95% CI 1.36-2.00) but did not differ for hospitals without a policy change. Severe ROP and necrotizing enterocolitis did not differ between epochs for either group. The adjusted odds of any ROP were lower in recent years in both hospital groups.

**Conclusions:** Changing $SpO_2$ alarm policies was not associated with reduced mortality or increased severe ROP among infants born very preterm.

### Comparison of Initial Pediatric Outpatient Echocardiogram Indications between Community and Academic Practice

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**Objective:** To compare the appropriateness and diagnostic yield of initial outpatient transthoracic echocardiography (TTE) between a community pediatric cardiology practice and an academic children's hospital.

**Study design:** Initial outpatient pediatric TTE ordered by pediatric cardiologists between January and March 2014 at a community practice (Packard Children's Health Alliance [PCHA]; n = 238) and an academic tertiary center (Lucile Packard Children's Hospital [LPCH]; n = 76) were evaluated based on appropriate use criteria (AUC) released in December 2014. Multivariate logistic regression was used to identify predictors of "rarely appropriate" indications and abnormal TTE findings.

**Results:** Of 314 TTEs, 165 (52.5%) were classified as "appropriate," 40 (12.7%) were classified as "may be appropriate," 100 (31.9%) were classified as "rarely appropriate," and 9 (2.9%) were unclassifiable. The proportion of abnormal findings did not differ between the 2 practice settings (5.3% for LPCH vs 7.6% for PCHA; $P$ = .61). TTEs performed at PCHA were significantly more likely to be "rarely appropriate" (OR, 2.57; 95% CI, 1.28-5.15; $P$ = .008). Children aged <1 year (OR, 1.90; 95% CI, 1.03-3.50; $P$ = .04) and ordering providers with <10 years since the completion of their fellowship (OR, 2.15; 95% CI, 1.20-3.87; $P$ = .01) were associated with "rarely appropriate" indications. "Appropriate" TTEs were associated with abnormal findings (OR, 8.69; 95% CI, 1.77-42.68; $P$ = .008).

**Conclusion:** The community practice was independently associated with greater inappropriate ordering of initial outpatient pediatric TTEs compared with the academic practice. The assessment of practice patterns following AUC release should account for physician and practice-related factors that could influence differences in TTE ordering patterns.

### Suicidal ideation, suicide planning, and suicide attempts among adolescents in 59 low-income and middle-income countries: a population-based study

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**Background:** Suicide is a major global health challenge and a leading cause of death among adolescents, but research related to suicide has concentrated on high-income countries. We aimed to estimate the prevalence of suicidal ideation, suicide planning, and suicide attempts in adolescents from 59 low-income and middle-income countries.

**Methods:** In this population-based study, we used data from the Global School-based Student Health Survey of schoolchildren aged 13–17 years between 2003 and 2015, in 59 low-income and middle-income countries across six WHO regions. Using a meta-analysis with random effects, we computed the sex-based and age-based estimates of regional and overall prevalence of suicidal ideation, suicide planning, and suicide attempts.

**Findings:** Our sample consisted of 229 129 adolescents (mean age 14·6 [SD 1·18] years; 111 082 [48%] boys and 118 047 [52%] girls). The overall prevalence of suicidal ideation was 16·9% (95% CI 15·0–18·8), suicide planning was 17·0% (14·8–19·2), and suicide attempts was 17·0% (14·7–19·3) in the 12 months preceding survey completion. The African region had the highest prevalence of suicidal ideation (20·4%, 17·3–23·6) and suicide planning (23·7%, 19·1–28·3), and the western Pacific region had the highest prevalence of suicide attempts (20·5%, 14·3–26·7). Southeast Asia had the lowest prevalence of ideation (8·0%, 4·5–11·5), planning (9·9%, 5·0–14·8), and attempts (9·2%, 5·1–13·3). Girls had higher prevalence than boys for suicidal ideation (18·5%, 16·4–20·6 *vs* 15·1%, 13·4–16·7), suicide planning (18·2%, 15·8–20·6 *vs* 15·6%, 13·7–17·6), and suicide attempts (17·4%, 15·0–19·8 *vs* 16·3%, 14·0–18·6). Adolescents aged 15–17 years had higher prevalence than those aged 13–14 years of suicidal ideation (17·8%, 15·8–19·8 *vs* 15·9%, 14·1–17·6), suicide planning (17·8%, 15·7–20·0 *vs* 16·3%, 14·7–17·9), and suicide attempts (17·6%, 15·2–20·0 *vs* 16·2%, 13·8–18·5).

**Interpretation:** Suicidal thoughts and behaviours are prevalent among adolescents in low-income and middle-income countries, particularly in the African and the western Pacific regions, and particularly among girls and adolescents aged 15–17 years. Targeted suicide prevention initiatives are needed and should take into account the diverse range of cultural and socioeconomic backgrounds of the countries.

**Analysis of the Seasonal Trend of Congenital Heart Defects**

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**Objective:** To determine the seasonal trend of congenital heart defects (CHDs) in China using hospital-based clinical data.

**Study design:** We included 40 501 patients with CHD hospitalized at the Shanghai Children Medical Center between 2006 and 2017. The birth rate of CHD in each month was adjusted by sex, year of birth, and monthly birth rate of the general population. Negative binomial regression models were used to assess the seasonal trend of CHD.

**Results:** The included patients consisted of 22 600 boys (55.8%), resulting in a male-to-female ratio of 1.26:1. Among subtypes of CHDs, ventricular septal defects and atrial septal defects were the most common, accounting for 39.7% and 12.6%, respectively. A statistically significant seasonal trend in the monthly birth rate of patients with CHDs was found; the highest relative rate of CHD was found in October and the lowest in April. After adjusting for the potential confounders, the highest relative rate of CHD was found in October and the lowest in November.

**Conclusions:** There seems to be a significant monthly birth rate variation of CHDs in China. The highest relative rate of CHDs occurred in October, suggesting possible maternal exposure to environmental hazards from January to March. These hazards may include air pollution, virus infection, and unhealthy lifestyle behaviors during the Spring Festival.