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Original Research Article

Perceived changes in knowledge and confidence of doctors and midwives after the completion of the Standardized Trainings in Obstetrical Emergencies

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ABSTRACT

Background and objectives: There are only few training programs in obstetric emergencies currently in use and only some of them were evaluated with an adequate sample of participants. Therefore, we present the evaluation of the novel Standardized Trainings in Obstetrical Emergencies (STrObE), conducted in Lithuania. The aim of this study was to analyze whether participants' self-reported knowledge and confidence increased after the trainings, and whether the impact of the trainings was long-lasting.

Materials and methods: Data was collected across the majority of hospitals providing secondary and tertiary obstetrical care in Lithuania in 2015. A total of 650 obstetricians-gynecologists and midwives attended the trainings; 388 (response rate 59.7%) of them filled in the initial questionnaire before the trainings, 252 (64.9%) immediately after, 160 (41.2%) 6 weeks after, and 160 (41.2%) 6 months after the trainings, which was the final sample for the analyses. Participants used a Likert-type scale to evaluate their knowledge and confidence about management of urgent obstetrical situations: vacuum-assisted vaginal delivery, shoulder dystocia, postpartum hemorrhage, preeclampsia/eclampsia, early preterm labor, and dystocia. We assessed how participants' self-reported knowledge and confidence changed after the trainings (compared to before the trainings) and how long the effect was retained for.

Results: The mean score of self-reported knowledge in obstetrical emergencies increased immediately after the trainings comparing to the scores before the trainings ($P < 0.001$) and it did not differ further between the three time points after the trainings (i.e. immediately, 6 weeks, and 6 months; $P > 0.05$). The same pattern was observed for self-reported confidence

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scores. The increase in self-reported knowledge and confidence after the trainings was stable. Moreover, the self-reported knowledge and confidence gains were greater for those participants with lower work experience, although benefit was seen across all experience levels.

Conclusions: STroBE improved participants' self-reported knowledge and confidence and lasting positive effects were observed for at least 6 months after the initial trainings. Moreover, the trainings were more beneficial for those with lower work experience, although they benefited all the participants.

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1. Introduction

Obstetrical emergencies, such as early preterm labor (neonates born under 32 weeks of gestation) [1], preeclampsia and eclampsia [2], postpartum hemorrhage [3], shoulder dystocia [4], and vacuum assisted vaginal delivery [5] are sudden and life-threatening medical conditions for both the mother and the neonate. Therefore, obstetricians must be prepared to recognize them immediately and proceed through an orderly sequence of steps in order to achieve good mother and neonate outcomes.

Whether outcomes of these life-threatening situations will be favorable or not depends on their management. Thus, all maternity care providers should regularly update their knowledge, skills, communication, and teamwork competence on the obstetric emergency situations to provide the best quality management of a patient. Strategies to reduce adverse outcomes of emergency situations in obstetrics have focused on infrastructural changes (development of protocols, guidelines and checklists) [6-12], regular team briefings [6,7], and the use of simulations and clinical drills [6-11].

A systematic review of worldwide literature on training in obstetric emergencies found few training programs and fewer that were evaluated with adequate sample size [13]. Most authors used the four levels Kirkpatrick's theoretical model to evaluate whether a training method is effective [14]. The four levels include the following: 1, reaction (to measure participants' satisfaction); 2, learning (to measure improvements of trainees' knowledge and confidence); 3, behavior (to measure implementation of learned skills and behavior into clinical practice); and 4, results (to measure the impact of trainings on the organization and patient outcome). Several studies showed a positive impact on patients or organization after the trainings in obstetric emergencies in the United Kingdom and Denmark [9,10], or improvement of knowledge and confidence after the trainings in obstetrical emergencies [15-19]. However, the studies had several limitations, including being single-center studies with no randomization of the participants allocated to different training groups. There is a need for innovative training methods with more emphasis on team rather than individual training, especially in obstetrics, which is behind in using simulation as a training method [20,21].

To improve maternal and newborn health care in Lithuania, Standardized Trainings in Obstetrical Emergencies (STroBE) was designed. Trainings were conducted across

Lithuania including the majority of the hospitals providing secondary and tertiary obstetrical and neonatal care for the first time. It was expected that STroBE would improve maternal and neonatal health care through equipping obstetricians and midwives with up-to-date knowledge and hands-on experience. Based on previous studies [10,15-19,22-24], we expected to find that participants' self-reported knowledge and confidence would increase after the trainings and that the impact would potentially be long-lasting.

2. Materials and methods

Newly developed STroBE was based on positive experience of ALSO® courses in Lithuania [23] and other countries [18,19,24,25]. STroBE was performed in 27 of the 32 Lithuanian hospitals, which provide 95% of secondary and tertiary obstetric and neonatal care. While in ALSO® course [26] learning occurs via syllabus reading, didactic lectures, and hands-on skills stations, in STroBE we used a learning method including online material and hands-on simulation training with a multidisciplinary team-based approach. The online material consisted of lectures, videos, and algorithms based on national diagnostic and treatment guidelines of perinatal care. These national guidelines were presented in 2015 and their content on the relevant topics to the trainings was based on the international clinical guidelines (i.e. [27-35] and alike). During STroBE the participants acted in the groups of three (in roles of a leader, an assistant, and an assessor). To simulate a real situation that might occur in obstetric emergency, participants had to solve several scenarios according to the standardized algorithms (Fig. 1) on mannequins using medical equipment. The next focus of the trainings was to enhance the teamwork of participants by assuming previously mentioned roles. Participants acted out situations in groups of three by changing roles for each algorithm so that everyone played all the roles, and give in-session feedback to each other. The evaluation and consultation of the supervisor, which was relevant in ALSO® courses, was excluded in order to reduce the number of instructors and trainings duration. Nonetheless, during every course there was one instructor, who was ready to help to teams if needed.

A prospective longitudinal design was undertaken over four time periods: before, immediately after, 6 weeks after, and 6 months after the trainings. We used a multiple-choice

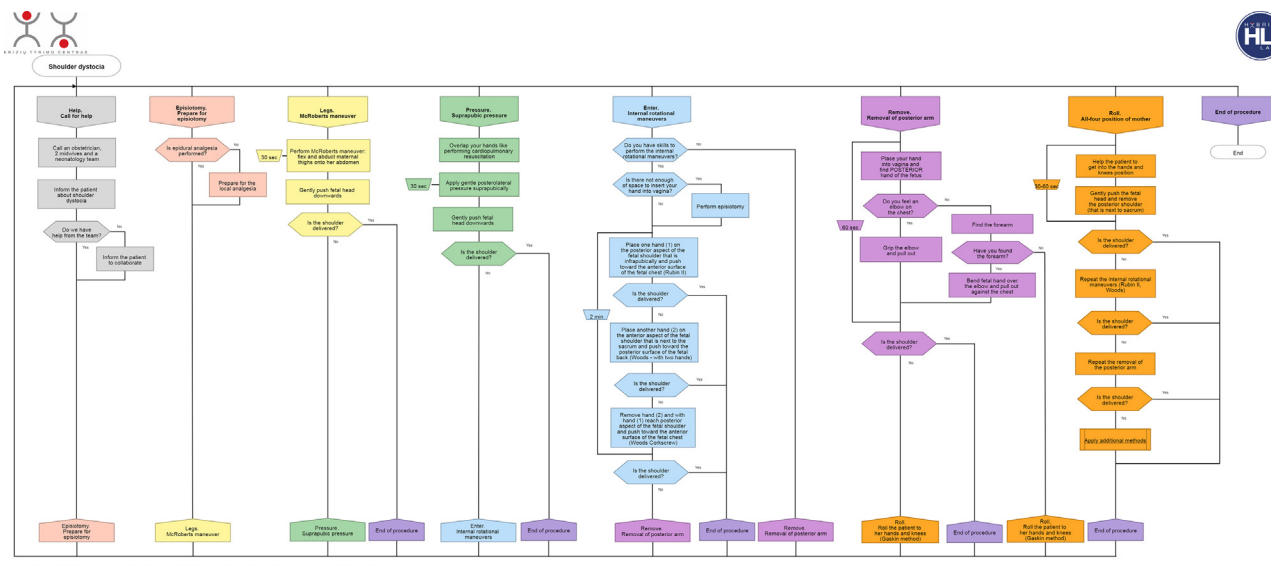


Fig. 1 – Sample of an algorithm for managing shoulder dystocia.

questionnaire, developed by our research group based on previous studies [10,15,16,24], to assess changes in participants' self-reported knowledge and confidence. The questionnaire consisted of three parts. The first part of the questionnaire collected general information about the participants (occupation, work experience in years) and their general satisfaction with the trainings. The second part of the questionnaire measured participants' knowledge in obstetric emergency situations: preeclampsia and eclampsia, postpartum hemorrhage, shoulder dystocia, vacuum assisted vaginal delivery, preterm labor and dystocia. Knowledge was self-evaluated with 6 questions using a 5-point Likert-type scale (1 = poor, 2 = fair, 3 = average, 4 = good, 5 = excellent). The third part of the questionnaire measured participants' level of confidence to manage obstetric emergency situations, which was evaluated with 6 questions using a 4-point Likert-type scale (1 = terrified, 2 = scared, 3 = coping, 4 = comfortable). The validity of the questionnaire was assessed in the pilot study with a sample of 30 participants, taken from the respondents at time one (i.e. before the trainings). The pilot test achieved high internal reliability (Cronbach's $\alpha = 0.90$) [36]; hence, no changes were made to the questionnaire. The data from the pilot study was included in the main study.

Following the ethics approval to conduct the study issued by the Bioethics Centre, Lithuanian University of Health Sciences (No. BLC-MF-101), all participants attending STObE ($n = 650$) in 2015 were invited by e-mail 3 days prior to the trainings to participate in the current study. Those attendees who agreed to participate in the current study ($n = 388, 59.7\%$) were sent an informed consent form and the coded online questionnaire, described above. We further sent the online questionnaire three times: immediately after, 6 weeks after, and 6 months after the completion of the trainings. Some of the participants were excluded from the final analyses due to incomplete data. The description of the analyzed sample ($n = 160$) appears in Section 3.

2.1. Statistical analysis

To test whether STObE was successful and participants' self-reported knowledge and confidence increased after the trainings, we ran two factorial one-way repeated-measures ANOVA models. These models evaluated whether the changes in knowledge and confidence were transient (i.e. lasted for less than 6 months) or long-lasting (i.e. lasted for at least 6 months). We assessed the change in knowledge and confidence between the baseline (time point 1) and the three other time points in participants who completed all four questionnaires ($n = 160$; Kirkpatrick's level 2, learning). In each ANOVA model, we had a categorical independent variable – time (four levels: before, immediately after, 6 weeks after and 6 months after the trainings) and a continuous dependent variable – either self-reported knowledge (model 1) or confidence (model 2). Any significant effects were broken down with the follow-up pairwise comparisons using Bonferroni corrections. Mauchly's test of Sphericity was performed to see if sphericity assumption was violated. If the sphericity was violated, results are reported with Greenhouse–Geisser corrections. Finally, we also ran two linear regression models to predict the change in self-reported knowledge (model 1) and confidence (model 2) from years spent working at the hospital (i.e., years of work experience). Data were analyzed using the SPSS 22.0 [37]. A P level of less than 0.05 was considered significant.

3. Results

A total of 650 midwives and obstetricians–gynecologists attended STObE in Lithuania. There were 388 participants who agreed to participate in the study and filled out the questionnaire before the trainings (time point 1). Immediately after the trainings (time point 2), 252 participants filled in the

questionnaire; 6 weeks after the trainings (time point 3), 160 participants; and 6 months after the trainings (time point 4), 160 participants (Fig. 2). The final analyses were performed on 160 participants who completed the questionnaires at all four time points (Table 1). Participants' satisfaction with STrObE was measured by asking them if they agreed to the statement that the trainings were relevant to their clinical work. The majority (92.8%) of the participants included into the study agreed or strongly agreed that the trainings were relevant, and none considered the trainings irrelevant when asked at time point 2 (Kirkpatrick's level 1, reaction) (Table 2).

Mauchly's test of sphericity indicated that the assumption of sphericity was violated for self-reported knowledge ($\chi^2_2 = 25.36$, $P = 0.049$) and confidence ($\chi^2_2 = 34.44$, $P = 0.001$). Repeated-measures ANOVA indicated the main effect of time on self-reported knowledge ($F_{2,49,214.42} = 22.37$, $P < 0.001$). The mean value of knowledge of obstetrical emergencies differed between the four time points in a way that there was an increase in self-reported knowledge scores immediately after the trainings compared to the scores before the trainings but no differences between the three time points after the trainings (Fig. 3). There was also the main effect of time on confidence ($F_{2,43,216.36} = 16.36$, $P < 0.001$). Confidence increased immediately after the trainings comparing to before the trainings and did not differ between the three time points after the trainings (Fig. 4).

Furthermore, as indicated with the linear regression model, work experience predicted change in self-evaluated knowledge ($F_{1,252} = 32.57$, $P < 0.001$) and explained 11.1% of variance (adjusted R square). When work experience increased in years, the change in self-reported knowledge decreased, implying that professionals with lower work experience reported gaining knowledge in a greater degree after the trainings ($\beta = -0.34$, $P < 0.001$). Analogously, work experience predicted change in self-evaluated confidence ($F_{1,252} = 16.44$, $P < 0.001$) and explained 5.8% of variance. With each additional year of experience, the gain in confidence was reduced by 0.25 points ($P < 0.001$).

4. Discussion

We evaluated the effectiveness of STrObE in Lithuania in terms of its impact on participants' reported knowledge and confidence in managing obstetrical emergencies. This training method had a positive effect on the participants' satisfaction, and improved their self-reported knowledge and confidence after the trainings. Such increase in self-reported knowledge and confidence was stable when re-measured 6 weeks and 6 months after the trainings. Hence, STrObE had long-lasting observable benefits to participating doctors and midwives. Additionally, specialists with lower work experience at the

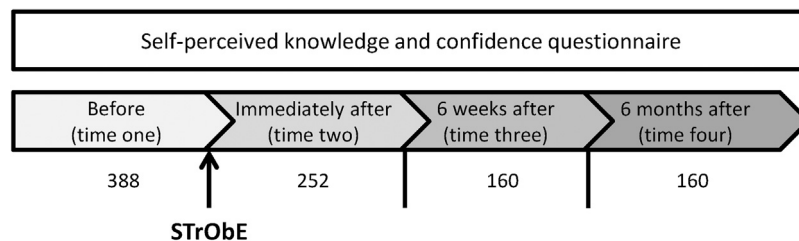


Fig. 2 – The number of the participants who filled in the questionnaire at each time point of the study.

Table 1 – Characteristics of the participants.

| | Midwives | Doctors | Gender | | Total |
|--|------------|------------|------------|------------|-----------|
| | | | Females | Males | |
| Attendants at time point 1 ^a , n (%) | 201 (51.8) | 187 (48.2) | 286 (73.7) | 102 (26.3) | 388 (100) |
| Experience of attendants at time point 1, mean (SD), years | 25 (10.7) | 25 (13.5) | 25 (12.3) | 23 (11.8) | 25 (12.2) |
| Participants who completed the study ^b , n (%) | 80 (50.0) | 80 (50.0) | 114 (71.3) | 46 (28.7) | 160 (100) |
| Experience of participants who completed the study, mean (SD), years | 26 (8.6) | 25 (12.3) | 26 (10.4) | 22 (11.5) | 25 (10.7) |

^a Attendants at time point 1 are people who completed the initial questionnaire but dropped out of the further follow-up.
^b Participants who completed the study are people who completed all the follow-up questionnaires (at time points 1, 2, 3, and 4), and whose data were used in the analysis.

Table 2 – Participants' satisfaction with STrObE.

| Statement | Participants at time point 2 (n = 252) | |
|---|---|--|
| | Participants at time point 4 (n = 160) | Participants excluded due to incomplete data (n = 92) |
| Agreed or strongly agreed that trainings were relevant to their clinical work | 150 (93.8) | 84 (91.3) |
| Partly agreed that trainings were relevant to their clinical work | 10 (6.2) | 6 (8.7) |

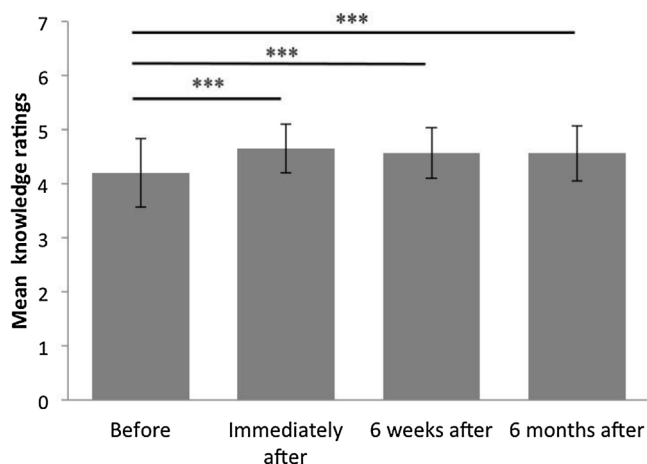


Fig. 3 – Knowledge ratings at four different time points. Error bars indicate standard error of the mean. * indicates significance differences ($P < 0.001$) from post hoc multiple comparisons (Bonferroni corrected).**

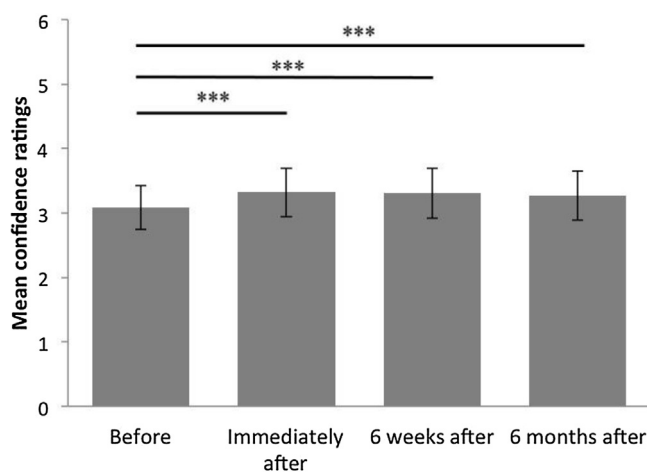


Fig. 4 – Confidence ratings at four different time points. Error bars indicate one standard error of the mean. * indicates significance differences ($P < 0.001$) from post hoc multiple comparisons (Bonferroni corrected).**

time of the trainings reported gaining knowledge and confidence in greater degree after the trainings. Therefore, the trainings were more effective for specialists earlier in their careers.

We evaluated STrObE based on the two levels of Kirkpatrick's model [14]. Level 1 of the Kirkpatrick's model is *reaction*, and our data revealed that participants had a positive attitude toward the trainings program. Similar results were obtained in other studies performed in Denmark [10] and the United States [18] where doctors and midwives were equally satisfied with similar courses in obstetrical emergencies. Level 2 of the Kirkpatrick's model is *learning*. Participants' self-reported knowledge and confidence increased after the trainings compared to before the trainings (similar to [17–19]). Potentially, participants learnt new

skills and gained knowledge during the trainings. Importantly, the effect of STrObE learning was long lasting (i.e., observable 6 months after the trainings). Several studies, which measured knowledge in a different way than us, also reported that an increase in knowledge after courses was retained for up to half a year [10,19].

The second finding of the study was an association between the length of work experience and the gain in self-reported knowledge and confidence after the trainings. Doctors and midwives who had worked for fewer years at the hospital experienced a greater gain in self-reported knowledge and confidence after the trainings. Younger specialists may have had less previous background knowledge and experience, which could have affected their everyday confidence. Moreover, the trainings were rather innovative, using the online materials, working with the mannequins, etc. therefore they could seem more attractive for younger specialists. Trainings like STrObE are thus very helpful in boosting younger specialists' confidence, though they are also beneficial to the specialists who work in practice for longer. A study in Denmark evaluated a simulation-based trainings and did not find the association between knowledge improvements after the trainings and years of work experience [10]. Meanwhile, a systematic review of relationship between clinical experience and quality of health care observed a negative relationship between years of work experience and the quality of care that doctors provided in 52% of the reviewed studies [38]. In other words, doctors with lower work experience provided better care, suggesting that doctors with longer practice experience may need quality improvement trainings. It seems that the target group of the trainings depends on the content of the trainings and that the trainings may be effective to both younger and older practitioners. Indeed, in the current study, we observed that all specialists gained self-reported knowledge and experience after the courses. Therefore, STrObE could be recommended to specialists of different experience.

Despite the observed positive results, there were several limitations in the current study. The first limitation of our study was that neither the actual knowledge nor simulated performance of obstetric skills were assessed. It remains an open question whether self-reported knowledge obtained during STrObE translates into real life practice and benefits patients (according to Kirkpatrick level 3 and level 4 which are *behavior and results*) [14]. Nonetheless, the Ministry of Health in Lithuania reported that the frequency of cesarean section was lower by 1.2% and giving birth by cesarean section after the previous cesarean section was higher by 6.2% in the period after the trainings (i.e., 2015) comparing to the period before the trainings [39]. Thus, we can speculate that knowledge and confidence gained during STrObE benefited patients in Lithuania, although this change could have happened due to other factors as well (i.e., general improvement in the quality of medical treatment). Future studies should include simulated performance assessment to have a complete view of impact of the trainings and their effect on measurable clinical outcomes, such as perinatal morbidity and mortality of mother and neonate. The second limitation of the study is a high participants' attrition rate. Potentially, there was a selection bias and people who did not answer the questionnaire at all

four time points experienced a different effect on self-reported knowledge or confidence than those who answer at all four time points and were tested in the current study. Nonetheless, the rate of positive attitude toward the trainings was high in this group, when tested at time point 2 (immediately after the trainings).

5. Conclusions

Health care professionals were overall satisfied with STroBE, and reported improvement in knowledge and confidence for an extensive period of time after the trainings. The trainings were perceived as most impactful by specialists with lower work experience, although they benefited all the participants. Future research should evaluate the effect of such trainings on simulated performance and measurable clinical outcomes, such as perinatal morbidity and mortality of mother and neonate. STroBE being effective in Lithuania, we can recommend it implemented as one of the options in education of obstetrical emergencies across Europe.

Conflict of interest

The authors state no conflict of interest.

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