Revista Española
de Educación Médica

Simulation-based teaching of instrumental delivery with forceps: an exploratory systematic review

Enseñanza del parto instrumental con fórceps basado en simulación: una revisión sistemática exploratoria

Alvaro Herrera [1,*], Diego Berrezueta [2], Pablo Celis [3], Nicolas Cruz [4], Rosario Acuna [5], Catalina Larrain [6]

[1] University of Chile, Department of Obstetrics and Gynecology, Western School of Medicine, Santiago, Chile; levarito@uchile.cl . San Sebastian University, School of Medicine and Science. alvaro.herrera@uss.cl . ORCID ID: https://orcid.org/0009-0007-4861-2144
[2] University of Chile, Bachelor of Medicine, Faculty of Medicine, Santiago, Chile; diegoberrezueta@ug.uchile.cl , ORCID ID: https://orcid.org/0009-0008-1491-8572
[3] University of Chile, Bachelor of Medicine, Faculty of Medicine, Santiago, Chile; pablocelis@ug.uchile.cl , ORCID ID: https://orcid.org/0009-0002-6491-7339
[4] University of Chile, Bachelor of Medicine, Faculty of Medicine, Santiago, Chile; nicolascruz@ug.uchile.cl , ORCID ID: https://orcid.org/0009-0003-1997-8025
[5] San Sebastian University, School of Medicine, Chile; mrosarioaq@gmail.com , ORCID ID: https://orcid.org/0000-0001-6610-6690
[6] University of Chile, Department of Obstetrics and Gynecology, Western School of Medicine, Santiago, Chile; catalarrains@gmail.com, ORCID ID: https://orcid.org/0009-0008-3673-0773
* **Correspondence: Alvaroandresherrera2@gmail.com**

Received: 10/30/24; Accepted: 1/14/25; Published: 1/17/25

Summary: Introduction: The acquisition of skills for the care of instrumentalized births with forceps has become more challenging due to the decreasing rate of instrumental births worldwide. Therefore, it has become essential to optimize the teaching strategies and methods of these procedures in Obstetrics and Gynecology residents . **Objective:** To present the teaching methods reported in the literature for the care of forceps deliveries and their contribution to learning and skill acquisition in residents. **Material and methods:** A systematic review of the literature using the PRISMA Extension for Scoping Reviews protocol in the WOS and SCOPUS databases was carried out. Original articles published in Spanish and English, without time limits, referring to methods or models for teaching care of instrumentalized births with forceps were considered. Articles were selected according to the objective of the research. The authors independently reviewed and synthesized the information from the included articles. **Results:** Six studies were reviewed and organized into three categories: i) Types of teaching methods: high- and low-fidelity simulations were highlighted, as well as integrative simulation and lecture methods. ii) Effectiveness in skill acquisition and participant perceptions: progress in technical skills, increased confidence and satisfaction on the part of residents, and better clinical outcomes were evident. iii) Patterns and development of educational tools: advanced simulators allowed for the replication of clinical scenarios and optimization of the forces applied during the procedure, and immediate feedback allowed for the improvement of error correction. **Conclusions:** This review highlights the importance of simulation-based teaching methods and structured educational curricula to improve both the technical skills and confidence of residents in performing instrumental forceps deliveries.

Keywords: Childbirth; Forceps ; Medical education; Simulation; Obstetrics

Abstract: Introduction: The acquisition of skills for attending forceps-assisted deliveries has become increasingly challenging due to the global decline in instrumental delivery rates. Thus, optimizing teaching strategies and methods for these procedures in O bstetrics and G ynecology residents has become essential. **Objective:** To present the teaching methods reported in the literature for forceps-assisted deliveries and their contribution to skill acquisition, confidence building, and learning among residents. **Materials and Methods:** A systematic review of the literature was conducted following the PRISMA Extension for Scoping Reviews protocol. Searches were performed in the WOS

and SCOPUS databases, including original articles published in Spanish and English without temporal limitations, focused on teaching methods or models for forceps-assisted deliveries. Articles addressing the research objectives were selected, and the authors independently reviewed and synthesized the extracted information. **Results:** Six studies were included and categorized into three themes: i) Types of teaching methods: High- and low-fidelity simulations and integrative approaches combining simulations with theoretical classes were highlighted. ii) Effectiveness in skill acquisition and participant perceptions: Significant improvements in technical skills, increased confidence, and high satisfaction levels among residents were observed. These methods also contributed to better clinical outcomes for patients. iii) Patterns and development of educational tools: Advanced simulations allowed to replicate clinical scenarios and optimize the forces applied during procedures, and the real time feedback led to the improvement of error corrections. **Conclusions:** This systematic review underscores the critical role of simulation-based teaching methods and structured curricula in improving both the technical competence and confidence of residents in performing forceps-assisted deliveries. These findings highlight the importance of incorporating such methods to address the current gaps in clinical exposure and ensure the development of proficient obstetricians.

Keywords: Labor; Forceps; Medical education; simulation; Obstetrics

1. Introduction

Instrumental vaginal delivery (IVD), such as forceps-assisted vaginal delivery (FAVD) or vacuum delivery (VAD), can be a fundamental intervention in situations where spontaneous birth is risky (1). The main indications for opting for assisted delivery include a non-reassuring fetal state when the most expeditious route is vaginal, prolonged arrest of the second stage of labor, extreme maternal fatigue, and maternal diseases that advise against prolonged pushing (2). The choice between forceps and vacuum depends on the clinical and obstetric condition; instrumental delivery with forceps is preferred when controlled and directed traction is required, particularly in facial presentations, extreme prematurity, or in fetuses with abnormalities that increase the risk of intracranial hemorrhage, such as in certain coagulation disorders or bone demineralization (3). In contrast, vacuum is considered appropriate for situations where minor manipulation of the fetal head is sufficient (3).

PVI is not free of risks and complications. However, it has been shown that the incidence of complications decreases when the indications for its performance are strictly followed. In addition, it is recommended that the procedure be performed by experienced institutions and professionals (4). This highlights the importance of accurate, rigorous, competency-based teaching in PVI, allowing Obstetrics and Gynecology specialists to develop the necessary skills to provide the best health care for the mother and fetus (3).

Teaching in real clinical scenarios of HFV raises an ethical conflict, because humanized and personalized delivery is desirable to ensure a positive experience for pregnant women. In this sense, the need to train new specialists through direct teaching could contradict these principles (5). Furthermore, from a medical-legal perspective, a dilemma arises when a more trained operator is present and does not perform the procedure for the benefit of the trainee. This ethical-legal conflict underlines the complexity of balancing patient safety with current educational demands. (6)

In recent decades, there has been a significant decline in the overall birth rate (7), accompanied by a reduction in the PVI rate. For example, in the United States (US), the PVI rate decreased from 8.8% in 1990 to 3.2% in 2015, with a significant reduction in the PFV from 5.0% to 0.6% in the same period (8-9). On the other hand, in parts of China the PVI decreased from 10.6% in 1993 to less than 1% in 2010 (10). Furthermore, the PFV rate in 2002 was 1.9%, while in 2011 the combined PFV and PFAV rate was 1.107% (11-12). This trend is also evident in Europe. For example, in Spain, the PVI rate went from 15.1% during 2015 to 14.4% in 2019 (13-14).

The global decline in the rate of FPGA represents a significant challenge for the training of residents in Obstetrics and Gynecology. This phenomenon is correlated with the historical increase in cesarean sections in recent decades. For example, in the USA, an increase from 22.7% to 31.9% of cesarean deliveries was observed from 1990 to 2016 (15) (16). On the other hand, in China, in some

regions it increased during the period from 1993 to 2010 from 10.6% to 34.9% (10). Currently in the USA, a stable rate of 32.4% has been maintained, with 82.1% of the latter being low risk (nulliparous, full-term pregnancy, singleton fetus and cephalic position) (17). In the USA, studies have shown 10-fold variations in cesarean rates between hospitals ranging from 7.1-69.9%, and a 15-fold variation in women with low-risk pregnancies ranging from 2.4-36.5% (18). These findings could be due to modifiable factors such as patient preferences and variations in practice between different hospitals, thus influencing the rates described previously (19). It is relevant to consider that cesarean compared to PAP has higher rates of maternal morbidity, greater blood loss and an increase in fetal complications related to hypoxia (20). In fact, according to the consensus of the American College of Gynecologist Obstetricians and Gynecologists (ACOG), the Society for Maternal Fetal Medicine (SMFM) PAP, when the second stage of labor is prolonged and the operator is experienced, is a safe alternative to cesarean (19). It is worth noting that less than 3% of women who have attempted a PVI end up having a cesarean section (21). Therefore, it is essential that there is always a professional trained to resolve the delivery by instrumental means, guaranteeing a safe and effective alternative.

All this context determines a subsequent limitation of experiential learning opportunities and acquisition of skills for the FPVB procedure for Obstetrics and Gynecology residents. This reduction in clinical exposure to scenarios requiring instrumental delivery has generated concern about the sufficiency of FPVB training during Obstetrics and Gynecology specialization programs. A study revealed that 57% of final-year Obstetrics and Gynecology residents in the United States had completed 10 or fewer FPVBs, and only 39% of them felt prepared to perform this procedure independently (22). On the other hand, a survey of Obstetrics and Gynecology residents in the United States and Puerto Rico reported that 17% of 4th-year residents had never participated as the first surgeon in a FPVB. In addition, only 45% of final-year residents and 56% of graduates of the specialization program feel qualified to perform a FPVB (23). Another study conducted in the USA reviewed obstetric procedure reports of fourth-year residents between 2003 and 2019, showing that the number of cesarean sections per resident increased by 8%, while the number of FPVB decreased by about 75% (24). Finally, the latest data from 2023 show that the average FPVB in fourth-year residents was 4.9 births per resident (25).

The situation is even more worrying considering recommendations from expert associations, such as the Accreditation Council for Graduate Medical Education (ACGME) in the USA, which requires residents in Obstetrics and Gynecology to perform a minimum of 15 PVI as a primary surgeon in order to graduate (26). Regarding the grounds for this request, a study suggests that performing at least 13 PVAF during residency would have a high positive predictive value for its correct use in clinical practice (27). Regarding this requirement, there is no distinction between the number of PVAF or PVAV, nor is the learning path specified to achieve the expected results.

All of the above highlights the need to explore the teaching methods reported in the literature for the acquisition of skills in relation to the PVAF, in order to establish common ground and promote adequate learning in Obstetrics and Gynecology residents to overcome the difficulties imposed by the current context. Currently, simulation has taken on an essential role as an effective educational tool to make up for the lack of real clinical opportunities in various areas of clinical practice and to safeguard the safety of the student, teacher, and patient (28-29). Although it cannot replace the experience with a real patient, it has managed to reproduce environments of various levels of fidelity, controlled and safe where residents can practice complex procedures such as the use of forceps, without putting their patients at risk (30). Considering the above, this work presents an exploratory review with the objective of identifying and analyzing the teaching methods reported in the literature for the learning of the PVAF in Obstetrics and Gynecology residents, in order to establish common ground and make recommendations to optimize medical education.

2. Methods

Review protocol

This systematic review was conducted following the guidelines of the PRISMA Extension for Scoping Reviews (PRISMA-ScR) protocol (31) (Figure 1).

Search strategy

A search was conducted in the "Web of Science" and "SCOPUS" databases. Using the MESH and Thesaurus terms: "Medical education", "Forceps", "Simulation" and "Obstetrics". Filters were applied for English and Spanish languages, without delimiting by date. In addition, manual searches were conducted in the references of the selected articles. Of a total of 43 articles identified, 6 were selected for their direct relevance to the research objective.

Relevance screening and inclusion criteria

Original studies in English or Spanish were included in the search, including experimental studies, quasi-experimental studies, cohort studies, observational studies, surveys that provide data on the implementation, effectiveness or development of teaching methods, and technical or descriptive studies, without limitation by year of publication. Articles related to programs, methods or models of education related to learning PVAF in Obstetrics and Gynecology residents were selected, where perception, experience, acquisition of skills, development of aptitudes in Obstetrics residents, among other relevant results, will be evaluated. Reviews, editorials, opinions, narratives, comments, articles not related to our study population or whose full text was not available were excluded from the search.

Selection process

Once duplicate articles were eliminated, the authors independently reviewed the titles and abstracts of each study identified in the search, which were selected according to their relevance to the objective of this work. Those that met the inclusion criteria were chosen. Discrepancies were resolved by the authors together by reviewing the full text. To ensure transparency in the selection process, a flow chart was developed following the recommendations of PRISMA-ScR (Figure 1).

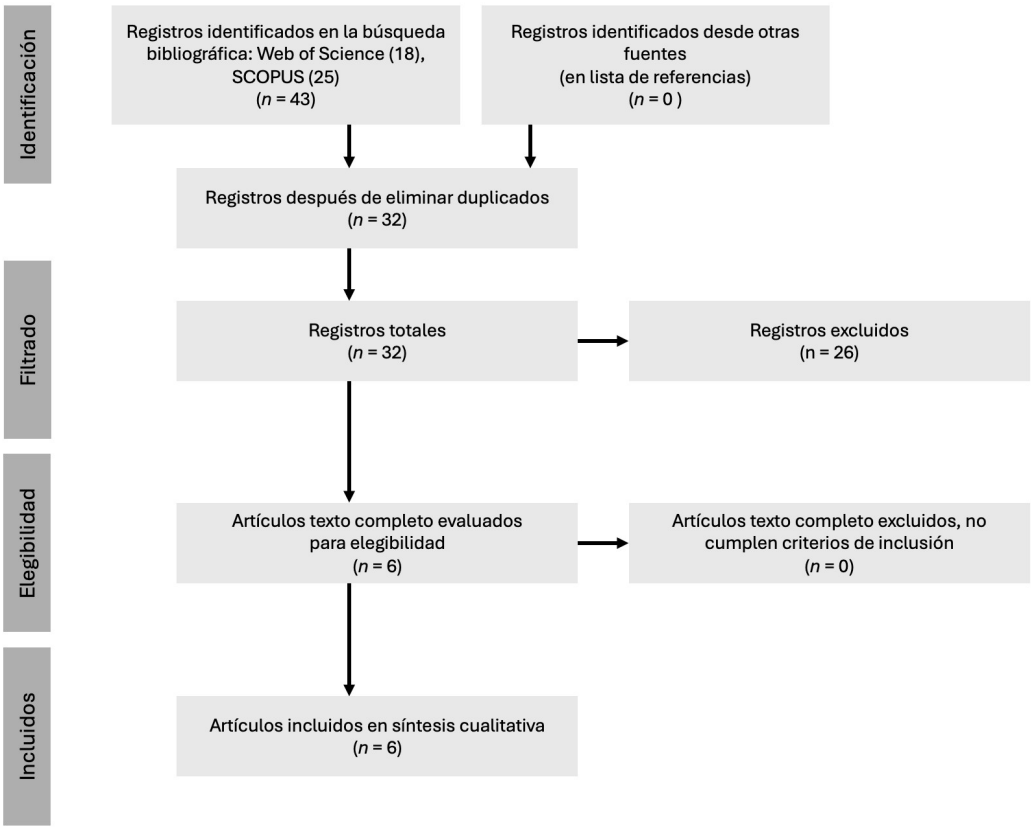

Figure 1. Search flowchart according to PRISMA-ScR criteria

Data collection

Subsequently, information was extracted from the included articles. For this purpose, the full text was reviewed and the data that referred to the development or application of PVAF teaching methods were selected. The following variables of interest were extracted: type of simulator used (high or low fidelity), type of skills taught (technical, theoretical, or both), residents' perception and satisfaction with the teaching method, specific skills acquired, and frequency or duration of simulation sessions. These variables were selected to provide a comprehensive view of the simulation methods used and their effectiveness in residents' learning.

Results and prioritization

The priority outcomes in this review were to identify the type of simulator and the structure of simulation-based teaching programs. Secondarily, the effectiveness of the simulation method in developing residents' skills, improving residents' confidence and satisfaction, and the impact on the acquisition of competencies necessary for performing FPV were prioritized. These outcomes were prioritized because they represent the key objectives of simulation training in Obstetrics and Gynecology, and reflect practical learning and preparation of residents in critical procedures. Finally, categories were constructed to represent the main findings of the studies.

Assessing bias in individual studies

The risk of bias assessment for each study was performed using specific tools based on the design of each study. For randomized studies, the ROB 2 (Risk of Bias 2) tool was used, assessing domains such as randomization, deviations from the intervention, missing data, outcome measurement, and outcome selection. For non-randomized studies, ROBINS-I was used, assessing bias domains such as confounding bias, participant selection, intervention classification, deviations from the intended intervention, missing data, outcome measurement, and selection of reported outcomes. The information obtained from these bias assessments was used to contextualize and analyze the reliability and robustness of the findings in the final data synthesis.

3. Results

Selection of studies

The systematic search allowed us to select a total of six studies in English according to the objective of the research (Table 1). The included studies were grouped into three main categories, based on the themes that emerged from the review:

1. Types of teaching methods.
2. Effectiveness in the acquisition of skills and perceptions of participants.
3. Patterns and development of educational tools.

Category I: Types of teaching methods

Simulation-based teaching methods identified in the studies included high-fidelity simulations and integrated approaches that combined simulation with theoretical activities.

- High-fidelity simulations: Three studies, Daniels et al. (32), Moreau et al. (33), and Rose et al. (34), employed advanced simulators, such as the Noelle S550 and BirthSIM, that replicate realistic PVAF clinical scenarios. These simulators allowed residents to practice in a controlled environment that mimics the complexities of real-life forceps use. Repetitive practice and immediate feedback were central components in these studies, resulting in tangible improvement in participants' technical skills.
- Integrated methods: Three studies, Becker et al. (35), Gosset et al. (36) and Wang et al. (37), combined simulations with lectures and practical workshops. These integrated approaches provided a balanced educational framework between theory and practice, resulting in

improved conceptual knowledge and technical skills of residents. The structured curricula helped reinforce the competencies needed to perform instrumental deliveries.

Category II: Effectiveness in the acquisition of skills and perceptions of participants

The effectiveness of simulation methods in improving residents' technical competence and confidence was a common finding in the reviewed studies.

- Improvements in technical skills: In the study by Wang et al. (37), residents trained with the rapid cycle deliberate practice (RCDP) method showed a significant improvement in their skills to perform PVAF. The RCDP group and a group receiving traditional teaching methods were evaluated in the execution of procedures, an immediate improvement was evident for the RCDP group with a test score of 92.00 vs. 88.00 respectively, and one year later the test was repeated with test scores of 86.00 vs. 85.50, thus evidencing the short-term effectiveness of the RCDP method, but the long-term impact appears to be limited.
- Increased clinical confidence and security: Rose et al. (34) showed that residents expressed increased confidence in their forceps skills after participating in high-fidelity simulations. This confidence correlated with improved overall patient outcomes at their institution, without specifically describing these.
- Improvements in clinical practice: Becker et al. (35) showed an increase in the percentage of FPVB performed by their institution after the implementation of an instrumental delivery curriculum. In the 2 years prior to implementation, FPVBs accounted for 1.0% and 0.7% of total deliveries, and in the 2 years after implementation, FPVBs increased to 2.0% and 2.6% of total deliveries. On the other hand, Gosset et al. (36) showed a 22–26% reduction in the rate of severe perineal lacerations after implementing a FPVB training curriculum.
- Satisfaction with teaching methods: In general, residents expressed high levels of satisfaction with the use of high-fidelity simulators as a teaching method. In the study by Daniels et al. (32), 81.6% rated the experience as excellent (5/5 points), and 66% rated the realism of the instrumental delivery simulation as excellent. In the study by Wang et al. (37), the average satisfaction and confidence levels of participants was 80%, highlighting the importance of immediate feedback and the possibility of practicing in an environment without risk to patients.

Category III: Patterns and development of educational tools

The reviewed studies also identified patterns in the development and evaluation of educational tools, especially simulators that mimic PVAFs.

- Development of advanced simulators: The study by Moreau et al. (33) highlighted the use of the BirthSIM simulator, which accurately replicated the forces exerted during a forceps delivery. This simulator not only allowed residents to improve their technical skills, but also provided a controlled environment to practice synchronizing the force applied by the forceps with the maternal expulsive force. It was shown that this could optimize and reduce the force exerted by the operator, thereby decreasing the risk of complications in the newborn and the mother. An improvement in the technique of the residents was observed, with an average reduction of 35% in the maximum force applied during the procedure, the maximum force exerted initially exceeded the recommended safety limit.

- Standardization and feedback: In the study by Daniels et al. (32), simulation-based training in obstetric emergencies allowed the identification of deficiencies in residents' decision-making and technique. Of the residents who decided on a vaginal delivery, one third of them did not attempt an instrumental delivery. In addition, a large variation in forceps technique was evident among residents, with 12.5% of residents unable to perform a forceps delivery. This highlights the need to adjust and standardize training. Furthermore, immediate feedback helped to identify and correct the technical deficiencies detected.

Table 1. Summary of study results

Author, Year and Country	Aim	Study design	Participants	Information gathering	Main Findings
Becker, et al. (2020, USA)	To evaluate the impact of a PVI educational curriculum on the percentage of PVAF and PVAV completed at the University of Alabama.	Retrospective cohort study	Third and fourth year residents of Obstetrics and Gynecology.	Birth record before and after implementation of the curriculum.	Knowledge assessment through written tests pre and post workshops where basic concepts of instrumental births were taught and then simulation in groups of 3-4 residents with 1-2 physicians. The percentage of PVI performed and the percentage of FFV performed compared to LVV increased. Comfort in using FFV and acquisition of basic knowledge about PVI improved.
Daniels et al. (2008, USA)	To evaluate the effectiveness of simulation-based team training for obstetric crises in residents.	Prospective observational study	19 Obstetrics residents, 22 nurses and 8 anesthesia residents	Checklists and error analysis during simulation. Post-course survey	Implementation of a 3-hour simulation course (introduction, simulation and debriefing), with application of different assessments that measured anticipatory attitudes towards a maternal-fetal emergency, severity and frequency of errors committed, and perception of simulation. The simulation was successful in identifying deficiencies in the execution of PVAF, with a large variation in PVAF technique between residents, with 12.5% unable to perform it. This allowed for a focus on education.
Gossett, et al (2016., USA)	To develop and implement a simulation curriculum for PVAF. To compare rates of severe perineal lacerations in trained and untrained residents.	Retrospective cohort study	103 residents of Obstetrics and Gynecology	Records of forceps deliveries and complications before and after implementation of the simulation curriculum.	Evaluation using a checklist prepared by experts of crucial steps in forceps to achieve a successful delivery before and after simulation. Reduction in severe perineal laceration rates by 22-26% in PVAF performed by residents who completed the program compared to those who did not.
Moreau et al. (2011, France)	To present and evaluate a control algorithm in the Birth SIM simulator for PVAF training.	Descriptive/ technical study	6 obstetricians with less than 12 months of obstetric experience	Technical evaluation of the control algorithm in the simulator, whose objective is measure the force exerted by	Instrumental traction force was measured with forceps synchronously and non-synchronized with maternal expulsive force. Initially, the "novices" exerted a force greater than that recommended, later when synchronizing with the maternal expulsive force, the force exerted required by the operators is less. The simulator is effective in replicating forceps delivery

				participants when performing PVAF.	conditions.
Rose, et al. (2019, USA)	To create and evaluate the impact of a simulation-based curriculum on resident education regarding PVAF.	Prospective cohort study	30 residents of Obstetrics and Gynecology	Surveys and standardized assessments before and after simulation sessions.	Knowledge was measured pre- and post-simulation, communication skills with patients regarding the use and complications of using forceps, and confidence in their use. Improves residents' confidence and skills in PVAF after simulation. Change in percentage of PVAFs performed at the University of California. Leveling of trust between different years of residence.
Wang, et al. (2024, China)	To evaluate the impact of the RCDP method on forceps training.	Randomized controlled trial	60 residents of Obstetrics and Gynecology	Evaluations, confidence surveys, and satisfaction scales.	Evaluation using a standardized checklist that examines the correct execution of the successive steps of the forceps. The RCDP method significantly improves short-term practical skills and student satisfaction with forceps teaching.

Abbreviations: IVB, Instrumental Vaginal Delivery; RCDP, Deliberate Rapid Cycle Practice; FFVB, Forceps Assisted Vaginal Delivery; VAVB, Vacuum Assisted Vaginal Delivery.

4. Discussion

The results of this review show that simulation-based teaching methods, especially those of high fidelity, have shown good results in improving the technical skills of Obstetrics and Gynecology residents in performing FPV. This educational approach has not only been successful in this specific area, it has also shown benefits in teaching complex surgical procedures in Obstetrics, such as the management of postpartum hemorrhage and complications of the second half of labor (30).

Similarly, previous research has highlighted the benefits of high-fidelity simulations in the training of various disciplines of health sciences or medical specialties. For example, in Emergency Medicine, its usefulness has been reported in the training of protocols such as advanced life support (38). In all these contexts, simulation has proven to be a valuable tool to recreate realistic clinical scenarios, increase confidence, reduce errors and, consequently, provide greater safety to patients, generating a positive impact on the quality of care (30, 39-40).

Furthermore, the results obtained with the use of high-fidelity simulations include significant improvements in technical skills and clinical decision-making in emergency situations (30). They are applicable both in individual practice and in teamwork (28). These findings consolidate simulation as a favorable educational resource for the comprehensive development of skills in health sciences.

Studies using high-fidelity simulators have not only proven to be particularly effective in replicating real clinical scenarios. They also allow for repetitive practice, independent training, and offer an ethical solution to the challenges of training residents in clinical settings without compromising patient safety. In the study by Wang et al. (37) using the RCDP method, the importance of repetitive practice is highlighted, which acts as a fundamental factor in perfecting technical skills. Another key advantage of simulation is the possibility of providing immediate feedback, favoring rapid improvement in residents' technical skills. In the studies by Daniels et al. (32) and Gosset et al. (36), it was shown that high-fidelity simulation combined with real-time feedback favors the correction of technical errors and also allows for standardization of technique among residents, a crucial element in ensuring patient safety. Standardization and documentation of simulation processes could act as a medical-legal support for possible complications, reduce the risk of malpractice, contribute to patient safety and decrease the number of complications related to the procedure. Regarding the latter, in the study by Gosset et al. (36), after evaluating a training curricula in PVAF, a reduction of between 22–26% was found in the rate of severe perineal lacerations, one of the main complications of PVAF (41).

Despite the favorable findings, the reviewed studies also highlight a recurring problem in the simulation field: long-term retention of skills. Research by Wang et al. (37) demonstrated that simulation, using the RCDP method, significantly improves short-term technical skills, however, the effectiveness decreases over time without continuous reinforcement. Other studies have also shown that the RCDP method is effective for short-term memory, but that the long-term impact is inconsistent (42-43). This suggests that the RCDP provides an advantage in the application of knowledge, but not in its retention compared to traditional teaching methods. This finding is consistent with research in other areas of medicine, such as neonatal resuscitation, where a progressive loss of skills acquired through simulation has been observed if repetitive training is not performed (44). These results underline the importance of structuring continuing education curricula to include periodic practices that strengthen long-term learning. According to ACOG, training in practical skills related to PVI and its continued maintenance should be promoted as part of a strategy to ensure safety and effectiveness in obstetric care (19).

On the other hand, the need to incorporate effective teaching methods, such as high-fidelity simulation, is also supported by the low exposure of residents to PVI. The review of obstetric procedure reports in the USA shows that in some cases residents complete their training with insufficient experience in the use of forceps, which can affect their confidence and clinical competence (22). The notable decrease in the number of FPVs performed by fourth-year residents, observed in a study between 2003 and 2019 (24), shows a worrying trend that affects the development of this skill. The most recent data from 2023 show an average of only 4.9 FPVs per resident (25). In this sense, some authors suggest performing a minimum of 13 FPVs during residency to obtain effective clinical performance (27). This demonstrates a mismatch between current exposure during training and practical need. In addition to the above, low confidence by residents to perform FPVs has been reported. A study showed that only 45% of fourth-year residents felt competent to perform a PVAF (23). In this context, the

implementation of simulation-based teaching methods can act as a necessary and fundamental tool to fill this practical deficit in Obstetrics and Gynecology residents.

In line with the above, the research by Becker et al. (35) showed that the implementation of a structured curriculum significantly increased the rate of forceps deliveries performed by residents, going from 1.0% and 0.7% in the two years prior to implementation, to 2.0% and 2.6% respectively in the two years after. This is related to the findings obtained by Rose et al. (34) who evaluated the impact of an educational curriculum based on the simulation of FPV. In their research, an improvement in confidence and skills with forceps by residents was observed, obtaining a positive correlation on the clinical results of patients in their institution, although the study does not specify these results. All of the above highlights the importance of continuing to improve educational curricula to ensure that all residents acquire the necessary skills, involving new safe and reliable methodologies, measuring results in an objective and quantifiable way, in the short and long term with patients in the institution.

In summary, the growing development of educational methodologies such as simulation represents an opportunity to improve the teaching and consolidation of complex obstetric skills, such as the use of forceps. The implementation of these educational methods can contribute to bridging the gap in opportunities, practical experience and confidence reported by Obstetrics and Gynecology residents regarding FPV training. The findings found in this review suggest that teaching methods that allow repetitive practice combined with real-time feedback, through high-fidelity simulators and practical workshops, are highly beneficial for developing technical skills and increasing residents' confidence in the use of forceps. Likewise, the integration of these approaches into structured curricula can maximize the benefits by improving the quality of training and ensuring safer and more effective learning.

Limitations

Despite the encouraging results regarding the benefits of simulation in the training of residents in PVAF, this review identified some limitations in the quality of the available evidence. First, several studies have small sample sizes, affecting the external validity of the results, so the extrapolation of these results should be done with caution, therefore research with larger samples and diverse environments is required to consolidate the external validity of findings regarding the benefits of simulation. In addition, the diversity in the simulation methods used (for example, high-fidelity simulators, low-fidelity simulators, and integrated approaches) reflects the absence of a widely accepted standardized method in the literature, which makes direct comparison between studies difficult and makes it difficult to establish universal guidelines for teaching PVAF, so this lack of uniformity could generate disparity in the acquired skills of residents. In addition, each study uses different evaluation criteria, measuring various aspects such as satisfaction, technical precision, and confidence, limiting the possibility of a uniform evaluation of the results. These limitations suggest the need for future research using standardized assessment methods and criteria to more accurately evaluate the impact of simulation methods on the learning and retention of skills in Obstetrics.

Recommendations

The results of this exploratory review can provide recommendations for optimizing the teaching-learning process of forceps instrumental delivery, as well as for directing future research aimed at finding novel educational formulas for the acquisition of obstetric skills. We recommend:

- Residency programs should consider integrating high-fidelity simulations and structured educational curricula.
- It is suggested that educational methods include activities that allow combining theory and practice.
- Educational methods should provide opportunities for repetitive practice, accompanied by immediate feedback.
- It is necessary to include ongoing educational strategies, such as periodic simulation activities, in order to facilitate the constant maintenance and updating of clinical skills, thus minimizing their long-term deterioration.
- Future research should focus on developing uniform evaluation methods and criteria, allowing for a more accurate comparison of results between different simulation studies in Obstetrics, contributing to the standardization of training among residents.
- Research should be conducted on the learning curve and the number of PVAFs required to ensure acquisition of competence.

- The development of new methods must be accompanied by studies that evaluate their impact on residents' learning, performance and confidence.
- Include in future research the impact and potential benefit of simulation training on adverse obstetric outcomes

5. Conclusions

- This scoping review highlights the importance of simulation-based teaching methods, especially those employing high-fidelity simulators, as essential tools to strengthen residents' technical skills, clinical performance, and confidence in performing FPLV. At the same time, it highlights the importance of designing structured educational curricula tailored to the specific needs of residents in training.
- Furthermore, the findings highlight the need to continue developing innovative educational tools, adapting training programs to global circumstances and thus ensuring adequate preparation to face the challenges inherent in clinical practice. Simulation techniques must be maintained over time and performed by a person who will subsequently supervise the resident during the actual procedure. This guarantees ongoing dialogue and mutual knowledge of what was trained in simulation, generating trust that facilitates the transition from simulation to real, tutored and successful procedures.
- It is also important to promote a holistic approach to education programmes that focus not only on the development of technical skills, but also on strengthening competencies such as communication, decision-making in adverse situations and teamwork. These competencies are essential to ensure safe, humane and quality obstetric care, in line with the ethical and legal requirements of modern medicine. Finally, it is emphasized that simulation should not be seen as a replacement, but rather as a valuable complement to real clinical practice, allowing residents to gain experience in controlled environments before being exposed to real situations.

Additional documentation: Annex I (Bias assessment according to ROBINS-I (non-randomized studies), Table Bias assessment according to RoB 2 (randomized study) and Table SWOT Analysis (Weaknesses, Threats, Strengths, Opportunities) on the use of forceps and simulation methods).

Funding : There has been no funding.

Declaration of conflict of interest : The authors declare that they have no conflict of interest.

Authors' contributions : The authors Álvaro Herrera, Diego Berrezueta, Pablo Celis, Nicolás Cruz, Rosario Acuña and Catalina Larraín, carried out: literature review, review of selected articles, data analysis, writing sections of the article, editing the article and approving the final version.

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