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Midwifery students' satisfaction with perinatal simulation-based training

Joeri Vermeulen[a,b,*], Ronald Buyl[b], Florence D'haenens[a], Eva Swinnen[c], Lara Stas[b], Leonardo Gucciardo[d,e], Maaike Fobelets[a,b]

[a] Department Health Care, Knowledge Centre Brussels Integrated Care, Erasmus Brussels University of Applied Sciences and Arts, Laarbeeklaan 121, 1090 Brussels, Belgium
[b] Faculty of Medicine and Pharmacy, Department of Public Health, Biostatistics and Medical Informatics Research Group, Vrije Universiteit Brussel (VUB), Laarbeeklaan 103, 1090 Brussels, Belgium
[c] Faculty of Physical Education and Physiotherapy, Rehabilitation Research, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Brussels, Belgium
[d] Faculty of Medicine and Pharmacy, Department of Obstetrics and Prenatal Medicine, Vrije Universiteit Brussel (VUB), Laarbeeklaan 103, 1090 Brussels, Belgium
[e] Department of Obstetrics and Prenatal Medicine, University Hospital Brussels, Laarbeeklaan 101, 1090 Brussels, Belgium

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ABSTRACT

Background: Simulation-based training has proved to be an effective teaching and learning approach in healthcare. Nevertheless, any assessment of its effectiveness should also take the students' perspective into account.
Aim: To validate the Satisfaction with Simulation Experience Scale (SSES) for use with midwifery students and evaluate midwifery students' satisfaction with perinatal simulation-based training.
Methods: Satisfaction with simulation was assessed using the SSES, a measurement tool translated from English to Dutch. Data was collected in four consecutive years (2016–19). A mixed methods design was used to capture both qualitative and quantitative data. Using the quantitative data, factor analysis was performed to assess the construct validity, while Cronbach's alpha was used to assess internal consistency. Qualitative data was assessed using thematic content analysis.
Findings: 367 SSES questionnaires were completed by 251 students. The exploratory factor analysis resulted in a three-factor model covering debriefing and reflection, clinical reasoning and clinical learning. Cronbach's alpha showed good internal consistency. Students were very satisfied with perinatal simulation-based training for all three factors: 4.30 (SD = 0.47) for debriefing and reflection, 3.97 (SD = 0.55) for clinical reasoning and 4.10 (SD = 0.46) for clinical learning. Satisfaction scores remained high and stable over the years investigated. Thematic content analysis identified 6 categories: simulation-based training is valuable, the need for more simulation-based training, fidelity, students, negative feelings, and preparation is vital.
Conclusion: Students were satisfied with the simulation-based training, experiencing it as providing added value to their education. Simulations gave them the opportunity to make and learn from mistakes in a safe learning environment.

Summary of relevance

Problem

As students' satisfaction is generally associated with greater learning involvement and motivation, it is important to create satisfying learning experiences. However, midwifery students' satisfaction with simulation-based training has been overlooked in the research literature.

* Corresponding author at: Erasmus Brussels University of Applied Sciences and Arts, Knowledge Centre Brussels Integrated Care, Laarbeeklaan 121, 1090 Brussels, Belgium.
E-mail address: joeri.vermeulen@ehb.be (J. Vermeulen).

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What is already known

Simulation-based training is a powerful and evidence-based teaching method for students and healthcare professionals.

What this paper adds

Students were satisfied with the current simulation-based training, experiencing it as providing added value to their education. Simulations gave them the opportunity to make and learn from mistakes in a safe learning environment. The Dutch version of the SSES is valid for use among midwifery students.

Introduction

Simulation-based training is a powerful and evidence-based teaching method in healthcare [1]. The simulation method incorporates goal-oriented role play, enabling students to practice a range of skills in an authentic context [2]. With respect to the types of procedures, simulation-based training can be divided into three categories – low-, medium- and high-fidelity – reflecting the respective degree of realism and the extent to which the simulation model (the mannequin) resembles a human being [3]. Low-fidelity human patient simulation mannequins are full-body static mannequins and include simple task trainers, while medium-fidelity ones are full-body with embedded software and interactive capacity [4]. They are controlled by an external, hand-held device and have limited physiological responses. High-fidelity mannequins are defined as 'life-like' mannequins with embedded software that can be remotely controlled by computer to allow for individualised, programmed scenarios, with the operator setting physiological parameters and responding to participants' interventions [4].

As high-impact educational and clinical method, simulation-based training has advantages over didactic approaches. In cases where real-life clinical situations occur only rarely, e.g. obstetric emergencies, simulation is an essential component of midwifery curricula [5]. Simulation experiences provide an effective teaching and learning approach as they allow students to become active and fully participative learners, in a safe and controlled environment [6]. As confirmed by the literature reviews of Cooper et al. [5] and Foronda et al. [7], simulation-based training is an effective tool for improving theoretical and clinical skills and allowing students to develop key clinical competences, especially those difficult to achieve during placements or in settings with limited learning experiences, e.g. communication, teamwork and critical thinking [6]. Another benefit of simulation-based training is the possibility to make mistakes and learn from them without risking patient lives [8]. A recent state-of-the-art review and meta-analysis of the value of simulation-based training in nursing education found that simulations additionally boost students' confidence levels and benefit their learning, including greater interaction between students and lecturers and an enhanced capacity to link theory to practice [8]. Simulations also benefit lecturers, providing them with a better opportunity to assess students in a safe environment [9].

Current simulation research is predominantly focused on the evaluation of various criteria such as knowledge improvement, skills development, confidence and critical thinking [10]. However, one potentially important element of simulation has been overlooked in the literature so far, namely student experiences [8]. Student satisfaction is an important result as it is generally associated with greater learning involvement and motivation [11]. Educationalists concluded that student satisfaction helps build self-confidence, in turn helping to develop skills and acquire knowledge [4]. One study evaluating medical students' satisfaction with simulation-based training found that 85% of them were satisfied with simulation as it improved their confidence in dealing with patient-related problems, as well as their knowledge, skills and communication [12]. Zapko et al. provide strong support for using simulation as a learning tool, indicating that nursing students were satisfied with the experience, felt confident in their performance, and appreciated that simulations were based on sound educational practices [13]. While it has been suggested that anxiety might impair learning and performance [14], a study exploring midwifery student experiences of simulation found that, although uncertainty, tension, confusion and disappointment were experienced, this did not negatively affect either their learning [15] or their satisfaction with perinatal simulation-based training.

Evaluation of nursing student's satisfaction with simulation based training indicated that both medium- and high-fidelity simulations are highly appreciated by students [4]. This is confirmed by a Norwegian study revealing that, irrespective of the level of simulation fidelity and the course year, students were mostly satisfied with simulation [16]. Levett-Jones et al. additionally suggested that student satisfaction may be related to competency and performance [4]. In addition, offering simulation-based training more than once in consecutive years is a valuable element in clinical instruction, potentially leading to increased student satisfaction and self-confidence [13]. An earlier study, exploring final-year midwifery students' experiences with perinatal simulation-based training, showed that repeat practice of simulation plays a key role in improving students' learning ability, self-confidence and ultimately their satisfaction [15]. The study of Mariani et al. describing the perceived gaps in nursing simulation research identified the need for more multisite, longitudinal and rigorous outcome-based studies [17].

Much of the evidence related to experiences with simulation-based training is currently based on studies in nursing, medical and multi-professional education [10], with few publications focusing separately or exclusively on the experiences of midwifery students [5]. Yet it is important for educational methods such as simulation to be appropriately evaluated regarding their capacity to create satisfying and engaging learning experiences [4]. Among other outcome measurements, student satisfaction has been shown to be a reliable criterion for assessing teaching and lecturers and has the potential to promote qualitative improvements in midwifery education [18]. Moreover, measuring midwifery students' satisfaction with simulation can boost understanding of their experiences, guiding education managers to further upgrade simulation sessions.

Midwifery students' satisfaction with simulation will be evaluated using the Satisfaction with Simulation Experience Scale (SSES), a scale originally developed by Levett-Jones et al. [4]. Other identified tools used to measure student satisfaction with simulation are explicitly associated with specific target groups such as emergency nurses (the Satisfaction Scale with Simulated Clinical Experiences - Escala de Satisfação com as Experiências Clínicas Simuladas -) [18] or correctional nurses (Satisfaction with Simulated Clinical Learning Experience Evaluation-Corrections) [19], or need more investigation in different cultural contexts (Student Satisfaction and Self-Confidence in Learning) [16]. The selected instrument, SSES, has been validated in English in Australia for undergraduate paramedic [9] and nursing [4] students but, to the best of our knowledge, has not been validated in Dutch (Belgium) or with midwifery students.

The aim of this study is to validate the SSES scale for use with midwifery students and evaluate midwifery students' satisfaction with perinatal simulation-based training using a Dutch version of the SSES.

Methods

Design and setting

A mixed methods design was used to assess midwifery students' satisfaction with perinatal simulation-based training. The SSES questionnaire featured a set of Likert-scale questions allowing a quantitative assessment and an open-ended question giving participants the opportunity to add comments about their simulation experiences and thus allowing a qualitative assessment. Data was collected at Erasmus Brussels University of Applied Sciences and Arts, Belgium. In Belgium, midwifery education is a direct-entry programme at bachelor's level based on recognised national guidelines for practice and education, and complies with the Bologna Declaration and the relevant European Directives [20]. With a strong focus on evidence-based practice, the programmes equip midwives to meet the demands of modern maternity care [21]. Structurally embedded in the training curriculum [22], perinatal simulation-based training takes place in an *in situ* simulation centre including a realistic birthing room, a neonatal care unit, a patient room and two debriefing rooms [15]. The high-fidelity mannequins (an adult male/female patient, a pregnant woman and a new-born) feature the latest computer hardware technology and extensive programming options to provide a realistic full-body presentation. Examples of perinatal simulation scenarios include postpartum bleeding, shoulder dystocia and umbilical cord prolapse. Each scenario lasts 10 min and is followed by a 30-minute facilitated debriefing. All scenarios sessions are videotaped, as video documentation enables replaying and feedback [23]. The video recordings form an integral part of the debriefing. Observing the scenario in the nearby debriefing room, students are involved in peer review and peer feedback and were instructed to focus on the inter-personal interactions and on the clinical reasoning skills of their peers. The debriefing structure is based on the Steinwachs model addressing three phases in the debriefing; description, analysis and application [24]. Across the span of the 3 year degree midwifery students participate in 27 perinatal simulation sessions (1st year: 7, 2nd year: 7, 3rd year: 13).

For this study, ethical approval was obtained from the University Hospital Brussels and the Vrije Universiteit Brussel (VUB), Belgium in March 2016 (registration number: B.U.N./143/201/627/467).

Materials

The Satisfaction with Simulation Experience Scale (SSES) [4], initially developed to assess the satisfaction of Australian nursing students with medium and high-fidelity simulation [19], was used. The SSES is an 18-item scale for which participants indicate their level of agreement with each item using a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree). The multidimensional scale covers three factors: (1) debriefing and reflection, nine questions (2) clinical reasoning, five questions (3) clinical learning, four questions. It also offers one open-ended question giving participants the opportunity to make any further comments about their simulation experiences. Its authors found the scale to be valid, demonstrating its high reliability with Cronbach's alpha coefficients of 0.94, 0.86, 0.85 for each factor [4]. The SSES was validated in Australia for second- and third-year undergraduate paramedic and nursing students [4,9]. Both these studies identified three factors, using the same narrative description for each one. However, both papers allowed different items to load on these three factors. In a first step, the supposed factor structure was checked using confirmatory factor analyses. With both models not adequately fitting the data, an exploratory factor analysis using varimax rotation was performed to identify the factor structure for the Dutch SSES to be used with midwifery students.

Though originally developed for nursing students, the SSES is inherently generic and can be easily replicated for other health-related disciplines [9]. For the present study, the SESS was independently translated by three researchers (JV, KB, ES) from English to Dutch. The different translations were combined, with any incongruences debated among the researchers until consensus was reached (two rounds). The finalised Dutch SSES was then backward translated to English by an independent researcher (RT). As recommended in literature [25], both versions were reviewed by researchers for conceptual equivalence, with no additional amendments found to be needed. Last but not least, the Dutch SSES was discussed with eight final-year midwifery students with regard to its readability and usability (JV) in February 2016. Apart from two small linguistic improvements, the students expressed no need for additional clarification.

Participants and data collection

All midwifery students enrolled in the 3-year direct-entry midwifery education programme were invited to participate in the study. Data collection was performed in May–June in 2016, 2017, 2018 and 2019 respectively. As such we were able to capture differences in satisfaction over the different course years and follow-up satisfaction rates for students' entire education. At the moment of data collection, all students had participated in at least three high-fidelity perinatal simulation sessions, both actively and as observers.

To increase response rates, several components of the Dillman Tailored Design Method [26] were applied, aiming to create a feeling for the importance in participating while at the same time anticipating and addressing any barriers to participation. This method involves at least three contacts with each candidate;

(1) Pre-notification: students were informed about this study by email four weeks prior to data collection.
(2) Initial distribution of the questionnaire: students were invited to voluntarily participate in the study by email, with an explanatory sheet and an informed consent form attached. They were asked to complete the questionnaire and a brief set of demographics online. Before starting the survey, students had to agree to participate via the consent form.
(3) A second and third reminder to non-responders; non-responders were identified and emailed by a researcher (MF) not involved in teaching or assessing the midwifery programme, thus ensuring anonymity.

Data analysis

Factor analyses

A Confirmatory Factor Analysis (CFA) is a structural equation modelling technique widely used to test if an assumed measurement model matches the information inherent to the data [27]. Our study used this technique to evaluate whether the proposed factor structure as described in previous published validation of the tool [4,9] was replicated in the data collected from 251 Belgian midwifery students. Put differently, a CFA was used to evaluate the construct validity of these tests for our Belgian sample.

Data was analysed using R (R Development Core Team, 2004) [28]. As the analyses required structural equation modelling, the data was analysed with the R-package lavaan [29] using maximum likelihood estimators. A lavaan output contains different fit indices, allowing users to evaluate how well the proposed model fits the data. First, if the chi-square is not significant, the model is considered acceptable since the observed covariance matrix is considered similar to the model-implied covariance matrix. However, this test only seems appropriate for small samples as it falsely reports a significant result with larger samples [29]. The Comparative Fit Index (CFI) is suitable for small ($n < 100$) sample sizes [30]. The recommended CFI value is 0.90 or, ideally, 0.95 [31]. Next, a value of the Tucker Lewis Index (TLI) between 0.90 and 0.95 is considered as a marginal fit, while values exceeding 0.95 constitute a good fit [32]. Concerning the Root Mean-Square Error of Approximation (RMSEA), a value below 0.04 describes a good fit and below 0.08 a moderate fit [33]. The graphical representations were compiled using the R-package semPlot [34].

In the event of the existing models not being able to explain the information inherent to the data (i.e., when all CFAs result in bad model fits), an exploratory factor analysis should be performed. First, a scree plot is performed using the R-package nFactors [35]. By means of a graphical inspection of the eigenvalues, the number of latent variables underlying this data is identified. Next, an exploratory factor analysis is performed using a varimax rotation, ensuring that the factors are uncorrelated. This facilitates their interpretation. The loadings of each item on these factors can be examined using the base R-package. Using this information, a new model can be constructed, with its properties examined by means of a new confirmatory factor analysis.

Internal consistency

The psychometric properties of the SSES-Dutch included an initial measurement of internal consistency reliability using Cronbach's alpha coefficient. An instrument may be said to have internal consistency reliability to the extent that all its subparts measure the same property [36]. The alpha coefficient of each factor was measured to establish initial values. As recommended in the literature, we consider an alpha value of 0.7 or more to be satisfactory [37].

Descriptive statistics (absolute values, mean values, standard deviation and percentages) were used to report the findings from the data gathered from the SSES.

Thematic content analysis

The responses to the open question were analysed in line with the principles of thematic content analysis, with all answers coded into recurrent and common categories [38]. To avoid interpretation bias, the thematic analysis was performed independently by two coders (JV, MF). As the next step, the categories were discussed to optimally reflect the data. Both coders organised the results and checked the final analysis for fit with the data, with significant examples of each category selected and translated into English. The categories are reported in order of frequency in Table 4 and illustrated with verbatim quotes.

Results

Characteristics of participants

A total of 367 questionnaires were completed over the consecutive years (participants vs. total students in 2016 n = 58.7%, 2017 n = 57%, 2018 n = 29.4%, 2019 n = 39.9%). 251 unique students participated, the majority of whom were younger than 26 years (n = 82.1%), female (99.2%), native Dutch speakers (57.4%) and in their first year of the bachelor course in midwifery (55.0%) (Table 1).

Validation of the SSES in Dutch for midwifery students

To identify the underlying factors, an exploratory factor analysis (EFA) was performed including only the first observation of all unique students (n = 251), as none of the previously published factor structures [4,9] seemed to adequately represent the data of our sample (for details, see Appendix 1 https://osf.io/nukpg/). The identified factors were narratively labelled as: debriefing and reflection (factor 1), clinical reasoning (factor 2) and clinical learning (factor 3). The following question-loading was found in this new model: questions 1–9 on factor 1, questions 10–12 on factor 2 and 12–18s on factor 3. Question 12 loaded equally high on both factor 2 and 3 (details see Table 2 and Appendix 1 in Supplementary material). The loading of question 12 on Factor 2 was 0.464 and on Factor 3 it was 0.506. Because the distinction between both loadings was very small, we decided to let this question be an indicator of both factors in our final model [28]. In order to check this statistical argument, face validity was established by the research team. The team confirmed that, in our Dutch translation, this item was a measure of both factors.

Besides construct validity, we also examined the questionnaire's reliability in terms of internal consistency. The results of Cronbach's alpha revealed that the proposed scales and the corresponding items had good internal consistency, with the Cronbach's alpha results for debriefing and reflection, clinical learning and clinical reasoning at 0.91, 0.83 and 0.83 respectively.

Satisfaction with simulation training

Satisfaction with simulation scores (mean and SD) for the factors were 4.30 (SD = 0.47) for debriefing and reflection, 3.97 (SD = 0.55) for clinical reasoning and 4.10 (SD = 0.46) for clinical learning (Table 3). The scores remained stable over the consecutive years for all three factors (Table 4).

Table 1
Socio-demographic characteristics participants.

		All years		2016		2017		2018		2019	
		N	%	n	%	n	%	n	%	n	%
Age	<21 years	123	49.0%	55	44.7%	26	21.1%	17	13.8%	25	20.3%
	21–25 years	83	33.1%	43	51.8%	21	25.3%	7	8.4%	12	14.5%
	>25 years	45	17.9%	23	51.1%	9	20.0%	5	11.1%	8	17.8%
Gender	Female	249	99.2%	120	48.2%	55	22.1%	29	11.6%	45	18.1%
	Male	2	0.8%	1	50.0%	1	50.0%	0	0.0%	0	0.0%
Native language	Dutch	144	57.4%	74	51.4%	30	20.8%	15	10.4%	25	17.4%
	French	78	31.1%	33	42.3%	19	24.4%	12	15.4%	14	17.9%
	Other	29	11.6%	14	48.3%	7	24.1%	2	6.9%	6	20.7%
Course year	1st year	138	55.0%	42	30.4%	45	32.6%	22	15.9%	29	21.0%
	2nd year	67	26.7%	42	62.7%	8	11.9%	5	7.5%	12	17.9%
	3rd year	46	18.3%	37	80.4%	3	6.5%	2	4.3%	4	8.7%

Table 2
Results of the Exploratory Factor Analysis.

Item	Factor loadings per latent variable		
	F1: Debriefing and reflection	F2: Clinical reasoning	F3: Clinical learning
1 The facilitator provided constructive criticism during the debriefing	**0.653**[a]	0.203	
2 The facilitator summarised important issues during the debriefing	**0.740**	0.150	
3 I had the opportunity to reflect on and discuss my performance during the debriefing	**0.780**	0.177	0.142
4 The debriefing provided an opportunity to ask questions	**0.837**	0.164	0.135
5 The facilitator provided feedback that helped me to develop my clinical reasoning skills	**0.643**	0.257	0.280
6 Reflecting on and discussing the simulation enhanced my learning	**0.587**	0.287	0.341
7 The facilitator's questions helped me to learn	**0.543**	0.279	0.365
8 I received feedback during the debriefing that helped me to learn	**0.593**	0.370	0.313
9 The facilitator made me feel comfortable and at ease during the debriefing	**0.552**	0.288	0.190
10 The simulation developed my clinical reasoning skills	0.204	**0.270**	0.804
11 The simulation developed my clinical decision-making ability	0.205	**0.279**	0.736
12 The simulation enabled me to demonstrate my clinical reasoning skills	0.238	**0.464**	**0.506**
13 The simulation helped me to recognise patient deterioration early		0.512	**0.209**
14 This was a valuable learning experience	0.308	0.525	**0.310**
15 The simulation caused me to reflect on my clinical ability	0.333	0.504	
16 The simulation tested my clinical ability	0.181	0.619	**0.206**
17 The simulation helped me to apply what I learned from the case study	0.291	0.600	**0.160**
18 The simulation helped me to recognise my clinical strengths and weaknesses	0.167	0.693	**0.183**

[a] Loading items per factor are shown in bold.

Table 3
Satisfaction with Simulation Experience Scale item scores.

Items	Mean (SD)
Debriefing and reflection	4.30 (0.47)
1 The facilitator provided constructive criticism during the debriefing	4.43 (0.58)
2 The facilitator summarised important issues during the debriefing	4.45 (0.55)
3 I had the opportunity to reflect on and discuss my performance during the debriefing	4.43 (0.63)
4 The debriefing provided an opportunity to ask questions	4.41 (0.60)
5 The facilitator provided feedback that helped me to develop my clinical reasoning skills	4.25 (0.60)
6 Reflecting on and discussing the simulation enhanced my learning	4.27 (0.63)
7 The facilitator's questions helped me to learn	4.10 (0.61)
8 I received feedback during the debriefing that helped me to learn	4.20 (0.61)
9 The facilitator made me feel comfortable and at ease during the debriefing	4.16 (0.72)
Clinical reasoning	3.97 (0.55)
10 The simulation developed my clinical reasoning skills	4.00 (0.62)
11 The simulation developed my clinical decision-making ability	3.96 (0.65)
12 The simulation enabled me to demonstrate my clinical reasoning skills	3.94 (0.66)
Clinical learning	4.10 (0.46)
12 The simulation enabled me to demonstrate my clinical reasoning skills	3.94 (0.66)
13 The simulation helped me to recognise patient deterioration early	3.76 (0.69)
14 This was a valuable learning experience	4.37 (0.65)
15 The simulation caused me to reflect on my clinical ability	4.12 (0.60)
16 The simulation tested my clinical ability	4.12 (0.60)
17 The simulation helped me to apply what I learned from the case study	4.30 (0.59)
18 The simulation helped me to recognise my clinical strengths and weaknesses	4.08 (0.71)

SD: Standard deviation.

An overview of the mean scores for each item can be found in Table 3. The four highest item scores were within the factor debriefing and reflection (4 highest scores of the 9 items of that factor). Students were most satisfied with the item: 'I had the opportunity to reflect on and discuss my performance during the debriefing' (Mean score: 4.43). The four lowest scores were found in the factor clinical reasoning (4 lowest scores of the 5 items of that factor). Students were least satisfied with the item: 'The simulation helped me to recognise patient deterioration early' (Mean score: 3.94).

A longitudinal assessment of the data was not possible since only 116 students completed the questionnaire more than once. Therefore, we decided to include only the first observation of all unique students in our quantitative analysis (n = 251).

Thematic content analysis of the open-ended questions

As in the original SSES, we offered one open question to back up the quantitative data asking participants if they wish to make any further comments, giving them the opportunity to share suggestions and comments about their simulation experiences. Eighty of the 367 completed questionnaires (n = 22%) contained responses. These were collated and categorised. Thematic content analysis identified 6 categories (Table 5). Categories are ordered by frequency and illustrated with participant quotes.

The participants considered simulations as added value for their midwifery course. Students described perinatal simulation-based training as instructive, constructive and relevant for their learning. Simulations gave students the opportunity to make and

Table 4
Satisfaction with Simulation Experience Scale: means by year and course year.

		Debriefing and reflection		Clinical reasoning		Clinical learning	
		n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Year	2016	121	4.28 (0.49)	121	3.97 (0.56)	121	4.15 (0.45)
	2017	56	4.39 (0.41)	56	4.01 (0.56)	56	4.10 (0.42)
	2018	29	4.20 (0.53)	29	3.92 (0.52)	29	4.04 (0.48)
	2019	45	4.28 (0.45)	45	3.94 (0.58)	45	4.02 (0.51)
Course year	1st year	138	4.3 (0.40)	138	3.99 (0.51)	138	4.11 (0.44)
	2nd year	67	4.23 (0.52)	67	3.87 (0.62)	67	4.03 (0.48)
	3rd year	46	4.23 (0.57)	46	4.06 (0.55)	46	4.18 (0.45)

SD: Standard deviation.

Table 5
Thematic content analysis: categories and quotes illustrating students' satisfaction with Perinatal simulation training.

Category	Participant exemplary quotes
Simulation-based training is valuable (34 mentions)	The simulation sessions really are an added value in midwifery education. They give us the chance to learn in an environment where we are allowed to make mistakes. As such, one is better prepared for practice (second-year student) The simulations are always very instructive and constructive, also because most lecturers are good at selecting and discussing relevant issues (second-year student)
Need for more simulations (33 mentions)	It would be better to have more (simulations), so that the skills ... become obvious and that we are really prepared for practice (second-year student) I think it would be useful, ... to repeat/replay the scenario after the initial simulation and debriefing. Probably the scenario that you did the last time (the correct thing) sticks better (first-year student)
Fidelity (technical issues: 7 mentions and scenarios: 4 mentions)	The more simulation corresponds to reality, the more valuable simulation will be. e.g. mannequin with an unrealistic voice, lecturers were recognised, impossibility to catch non-verbal signals, technical skills (administer an infusion, injections, ...) cannot be performed, environment labour room, ... (second-year student)
Students (number of students taking part in a simulation session: 5 mentions; involvement of students: 3 mentions)	One major weak point is that simulation sessions cover quite large groups (15 persons). If you don't feel at ease in this group, then the simulation will be less valuable (second-year student) Make the groups smaller so that each student can actively participate (first-year student) People not actively participating in simulations need to be involved, as otherwise they just take someone else, someone who wants to have a go. You always get the same people actively participating in simulations (second-year student)
Negative feelings (disappointment: 2 mentions; anxiety: 1 mention; confusion: 1 mention; uncertainty: 1 mention)	The necessary material is not always present in the simulation centre, e.g. Glucose 5% where we had to put in oxytocin, but couldn't find it. This got us confused ... (third-year student) Simulation is not effective when there is a fear of failure (third-year student)
Preparation is vital (3 mentions)	Suggestions: inform students beforehand about the content of the simulation session, so that they can read up that part of the course, allowing them to be really prepared to exercise the skills (second-year student) This (if students knew the content of the session beforehand) would be helpful for students who have the knowledge and skills, but are insecure and therefore don't perform optimally during the simulation (third-year student)

learn from mistakes in a safe and realistic learning environment. Students also emphasized the need for more simulations, acknowledging that the successful acquisition of competences in simulations benefit from repetitive scenarios. Repeat and the possibility to replay the scenario after the initial simulation and debriefing were stressed as pivotal for a positive learning experience. Highlighting the importance of fidelity in simulation training, students made some suggestions on ways to improve fidelity, namely a realistic environment (e.g. labour room), materials (e.g. equipment, mannequin's voice) and scenarios. They also wanted simulations to take place in smaller groups to improve students' active interaction and involvement. Students said that also reluctant students should be encouraged to participate actively in the simulation-based trainings, this might be facilitated when the trainings are organised in smaller simulation groups.

Some students mentioned negative feelings. On some occasions, students were disappointed and confused when training equipment/material lacked fidelity, was missing or not functioning. Feelings of anxiety and uncertainty were also mentioned, that was mainly the case when students did not know what to expect of the scenario and when they not felt prepared for the simulation-based training. Proper preparation was identified as vital for students' performance, with students suggesting being informed about the content of the simulation scenario beforehand as a way of decreasing anxiety and uncertainty which may enhance their learning experience.

Discussion

The aim of the present study was to validate the SSES scale for use with midwifery students and evaluate midwifery students' satisfaction with perinatal simulation-based training.

Our respondents were very satisfied with the simulation trainings, with their satisfaction scores remaining high and stable over four consecutive years (2016 till 2019), in line with the high scores reported in earlier studies [4,7,11,16]. A recent state-of-the-art review and meta-analysis of the value of simulation-based training in nursing education found that student satisfaction was high in most of the 43 analysed studies [8]. In line with our findings, no major differences were observed between the course years in previously published studies [12,16]. Satisfaction is generally associated with greater learning involvement, motivation 11] and has a positive impact on students' overall learning attitudes [9]. Students were most satisfied with the ability to reflect on and discuss their performance during the debriefing, confirming the importance of debriefing for their learning and satisfaction [17]. Conversely, students were least satisfied with items related to 'clinical reasoning', finding that perinatal simulation-based training was of limited help in developing clinical reasoning and clinical decision skills. In particular, simulation as an aid to recognising patient deterioration at an early stage scored low. It is important to acknowledge that performance may be severely impacted when the simulation lacks fidelity [39], with a lack of fidelity or technical issues possibly hindering the acquisition of clinical competencies, as demonstrated in an earlier study [15]. Second, when students are not adequately prepared for a simulation, their learning opportunities are limited [14].

Simulations were seen by our midwifery students as added value for their education, providing them with the opportunity to make and learn from mistakes in a safe learning environment and thus enhancing their learning. A recent review (2019) identified factors critical for simulation-based learning, including the provision of a safe learning environment where constructive feedback is provided, and where students are supported to learn from their mistakes [40].

There was a clear call from our respondents for more perinatal simulation-based training in their curriculum, a finding confirmed by other studies. [4,11,15] Students especially wanted simulation to be introduced early in the curriculum, a finding in line with findings from an Australian study exploring midwifery students' experiences of a simulation scenario for neonatal resuscitation 11]. An increase in simulation frequency and the structural embedding of perinatal simulations in the midwifery curriculum are recommended.

Fidelity of the simulation environment, scenarios and mannequins was identified as important for a positive simulation experience. The Basak et al. study (2016) on nursing students' perceptions of the use of patient simulators found that student satisfaction positively correlated to mannequin fidelity [41].

However, while students were in general satisfied with simulation, certain negative feelings were voiced, with some students expressing feelings of disappointment and confusion. Anxiety and tension were also mentioned, findings confirmed by a study exploring nursing students' experiences with simulation in which students reported feelings of being watched. Performance expectations, familiarity with the simulation environment and confidence with their peers were perceived as factors affecting their anxiety [42]. To reduce negative feelings and boost learning effectiveness, our students expressed a need for more targeted preparation, in particular wishing to be informed about the content of the scenario prior to the simulation session. A study exploring midwifery students' experiences of real-time simulation revealed that the realism created, along with role delegation, evoked unexpected emotions and stressful responses e.g. feelings of anxiety and insecurity about their performance [43].

We performed construct validity tests on the SSES-Dutch. First, a CFA showed that none of the previously published factor structures [4,9] seemed to adequately suit the data of our sample, meaning that these models could not be used for the SSES-Dutch. The reason that none of the previous factor structure represented our data might be explained by the fact that previously published factor structures were performed among nursing and paramedic students, both in Australia with different philosophical underpinnings and educational structures. We subsequently performed an EFA and a new CFA which showed a good model fit for the new SSES-Dutch model, coming up with a three-factor model with different question loadings compared to the previously published studies [4,9]. In contrast to the other two published validation studies of the SSES [4,9], we were unable to come up with an overall satisfaction-with-simulation score because we could not find an accurate model fit for a single-factor model. Consequently, we solely calculated scale scores and not overall satisfaction scores. Based on these results, we would recommend authors to calculate the three scale scores, and not the overall satisfaction score. The SSES-Dutch was found to have a good construct validity, demonstrating high internal consistency between its three scales: (1) debriefing and reflection (2) clinical reasoning and (3) clinical learning. Consistent with our results, the Cronbach's alpha scores of the original SSES [4] also showed good internal consistency: factor debriefing with an alpha of 0.83 versus 0.94, factor clinical reasoning with an alpha of 0.83 versus 0.86, and factor clinical learning with an alpha of 0.91 versus 0.85).

Questionnaires aimed at revealing student satisfaction represent a major contribution to developing and enhancing simulation as a learning method [16]. We opted for the use of the SSES, a score developed to assess the satisfaction of nursing students with simulation, to measure midwifery students' satisfaction, as the scale factors were in line with crucial concepts of simulation in midwifery (e.g. debriefing, clinical reasoning and learning) [44]. The selected instrument for data collection, SSES, was developed in Australia and translated into Dutch, possibly resulting in ambiguity in language and meaning [36]. The scale was originally developed for use with nursing students, nursing and midwifery are unique and distinct professions, hence the differences found in the factor structure may be accounted for by this difference. The items included non-woman centred language that is not appropriate for midwifery, further research on midwifery students may consider adapting items to be more midwifery focussed. The inclusion of items that incorporate more midwifery based care practices may also be considered in future focussing on the student's skills in communicating with the woman, facilitating informed decision making, or discussing relevant evidence with the woman. While the identified factor structure for the Dutch version of the SSES showed good internal consistency, more studies in various settings in different cultural contexts and other disciplines are recommended to further validate the SSES. Even though our participants were students of a programme based on national guidelines, in line with the Bologna Declaration and relevant European Directives, future research might want to validate the proposed questionnaire with midwifery students from other countries and educational systems as well.

To be able to follow up on non-responding students and thereby maximise the response rate, we opted not to use an anonymised survey. This might have had a positive impact on the SSE scores and a negative impact on the response rate. Although we applied the Dillman Tailored Design Method [26] over the entire study period to improve the response rate, the response rate decreased over the years (from 58.73% in 2016 to 39.9% in 2019). Possible explanations for this include the timing (the survey was conducted during a practical training period for nearly all students), and a misunderstanding whereby it was not clear to all students that they were supposed to complete the survey every year throughout their course. Consequently, we were unable to perform a longitudinal analysis on the data.

The open question was revealing as it allowed students to share their perspectives and to comment on aspects of their experiences that they felt were the most relevant [4]. Though only answered in 22% of the completed questionnaires, this qualitative data helped generate valuable information on students' satisfaction with perinatal simulation-based training and improved interpretation of the quantitative results.

Conclusion

The results of this study improved our understanding on how students value perinatal simulation training, offering education managers the necessary input to facilitate student learning and to design more effective simulation sessions. Our respondents emphasised the need for more simulation-based training and its introduction at an early stage in the course curriculum. The structural embedment of simulation-based training in the course curriculum is strongly recommended. Preparation is vital to reduce any negative feelings and boost learning effectiveness. Educators should endeavour to provide a safe learning environment that decreases student's anxiety and increases learning performance. The number of students in the simulation sessions should be limited so that students can participate both in an active and observing role. Fidelity of the environment and scenarios is of key importance, as it allows students to make stronger links between simulation and practice.

Author agreement

The article is the authors original work.

The article is not previously been published elsewhere (either partly or totally), and is not in the process of being considered for publication in another journal.

All authors meet the criteria for authorship (Women and Birth Guide for Authors, 2020), have seen and approved the manuscript being submitted and that all those entitled to authorship are listed as authors.

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Conflict of interest

None declared.

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Ethical statement

For this study, ethical approval was obtained from the University Hospital Brussels and the Vrije Universiteit Brussel (VUB), Belgium in March 2016 (registration number: B.U.N./143/201/627/467).

CRediT authorship contribution statement

Joeri Vermeulen: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Ronald Buyl:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Florence D'haenens:** Formal analysis, Writing - original draft, Writing - review & editing. **Eva Swinnen:** Formal analysis, Writing - original draft, Writing - review & editing. **Lara Stas:** Formal analysis, Investigation, Methodology, Software, Validation, Writing - original draft, Writing - review & editing. **Leonardo Gucciardo:** Formal analysis, Writing - original draft, Writing - review & editing. **Maaike Fobelets:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.wombi.2020.12.006.

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