

A Medical Student Obstetric Curriculum Consisting of Online Modules and a Normal Spontaneous Vaginal Delivery Simulation Exercise

Cynthia Abraham^{1,2}

¹Department of Obstetrics, Gynecology and Reproductive Sciences, Icahn School of Medicine at Mount Sinai and Mount Sinai Health System, New York, NY, USA. ²Department of Medical Education, Icahn School of Medicine at Mount Sinai and Mount Sinai Health System, New York, NY, USA.

Journal of Medical Education and Curricular Development
Volume 11: 1–5
© The Author(s) 2024
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/23821205241245295



ABSTRACT

OBJECTIVE: In many medical schools, students are exposed to obstetrics for 2 weeks during the third-year obstetrics and gynecology clerkship. Hence, the purpose of this study was to evaluate the effectiveness of a curriculum combining online obstetric modules and a normal spontaneous vaginal delivery (NSVD) simulation on medical student knowledge and comfort pertaining to obstetrics at the start of the clerkship.

METHODS: Students completed the curriculum at the start of the clerkship. They completed questionnaires before and after each module and the simulation. The questionnaires assessed knowledge, management comfort level, and satisfaction with module/simulation. Comfort level and satisfaction scores were based on a 1–5 Likert scale (1 = very uncomfortable/unfavorable, 5 = very comfortable/favorable). Satisfaction scores for online modules were compared with those for a historical cohort of traditional lectures on the same topics. Students also rated satisfaction with the curriculum.

RESULTS: Sixty students participated. Mean knowledge and comfort scores significantly increased from 7.2 to 9.2 ($P < .001$) and from 2.7 to 3.9 ($P < .001$) before and after the modules, respectively. Although satisfaction scores for traditional lectures were significantly higher than for online modules (4.7 vs. 4.4, $P < .001$), online modules were still favorably received. Mean satisfaction score for the NSVD simulation was 4.8. Overall, satisfaction score for the curriculum was 4.5.

DISCUSSION: An obstetric curriculum consisting of online modules and simulation significantly increases medical student learner knowledge and comfort and is associated with a high level of satisfaction.

KEYWORDS: medical student, obstetrics, simulation, online

RECEIVED: November 7, 2023. **ACCEPTED:** March 19, 2024.

TYPE: Original Research Article

FUNDING: The author received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CORRESPONDING AUTHOR: Cynthia Abraham, Department of Obstetrics, Gynecology and Reproductive Sciences, Icahn School of Medicine at Mount Sinai and Mount Sinai Health System, 1176 Fifth Avenue, 9th Floor, New York, NY 10029, USA.
Email: cynthia.abraham@mssm.edu

Introduction

Over the past 20 years, there has been a paradigm shift toward a competency-based educational framework. In this scheme, learners take on a more active role in their educational process. Learners also work with their teachers and environment to optimize outcomes for physician education. This emphasis on learner independence has been found to foster the solidification of lifelong learning skills.¹ Hence, it is important that educators utilize educational techniques to promote the independent learner in their success to meet core competencies. One method is the utilization of online learning for which there is overwhelming support. A meta-analysis of 201 studies showed that Internet-based instruction was associated with favorable educational outcomes for student physicians. There have been a significant number of other studies published on the efficacy of online learning in undergraduate medical education.² A study by Kwant et al compared text-based preparation with implementation of e-modules prior to participating in physical examination and basic medical skills training. E-modules were available for some stations while others still

had text-based preparation.³ Kwant et al found that performance on skill stations was significantly higher for those that had e-modules available compared with those that did not. The number of studies on the use of e-modules in undergraduate medical education pertaining to obstetrics and gynecology (OB/GYN) is very limited. A search on PubMed and MedEd Portal generated three articles. Although one of them addressed third-trimester bleeding, to date, there are none describing modules focused on core obstetric topics such as normal and abnormal labor, fetal heart rate monitoring, and postpartum hemorrhage.⁴

Another educational tool that promotes crystallization of skills is simulation. Over the past several decades, the use of simulation has increased significantly in the field of obstetrics. Although there is a plethora of research on the efficacy of simulation in obstetrics, the literature on its role in obstetric undergraduate medical education is also limited. Guidance on how to conduct simulation-based sessions focused on the medical student learner is even more scant but findings are promising. One study, published by Posner et al, described a simulation-



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without

further permission provided the original work is attributed as specified on the SAGE and Open Access page (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

based workshop in which medical students followed an obstetric patient's clinical course from presentation to spontaneous vaginal delivery and immediate postpartum care. They found that the workshop led to improved student confidence and knowledge during their first days in the obstetric service.⁵

In many medical schools, students are exposed to obstetrics for 2 weeks during the clerkship in OB/GYN. Prior to April 2022, students had expressed a need for supplemental educational resources fostering remote learning and a primer on the logistics of conducting a normal spontaneous vaginal delivery (NSVD). However, in April 2022, given changes in personnel and schedules, in-person lectures for the following obstetric topics were eliminated: normal/abnormal labor, fetal heart rate tracings, and third-trimester bleeding/postpartum hemorrhage. Students were required to complete a series of case-based online modules instead. A simulation module focused on conducting an NSVD was also created.

In this article, the outcomes of a medical student obstetric curriculum that combines online modules and simulation are presented. This curriculum was introduced in July 2022.

Methods

At the start of the obstetrics portion of the OB/GYN clerkship at the Icahn School of Medicine at Mount Sinai, students completed three online modules focused on normal and abnormal labor, fetal heart rate monitoring, and third-trimester bleeding and postpartum hemorrhage. Each module consisted of background information followed by cases. During each case, a clinical scenario was presented and students progressed through each by answering a series of questions that would lead to the next step in the patient's management. There was no time limit on the amount of time each learner could spend on each module. Students had access to the modules 24 h a day, 7 days a week.

Students also completed questionnaires via Google Forms before and after each module (Supplement 1). These questionnaires assessed knowledge, comfort level in managing the condition in the module, and satisfaction with the module. Maximum knowledge score for each module was 10. It was expected that students would adhere to the institution's honor code when completing the questionnaires. It was

expected that students did not refer to outside material when completing the questionnaires. Comfort level scores were based on a 1–5 Likert scale (1 = very uncomfortable, 5 = very comfortable). Satisfaction scores were based on the level of agreement with the following statements: "I found the content of this module useful" and "I liked the presentation of the material." These scores were also based on a 1–5 Likert scale (1 = highly disagree, 5 = highly agree) and then averaged. These questionnaires were not standardized but were piloted from July 2021 to January 2022. The modules were an optional learning tool during that interval of time.

Satisfaction scores for the online modules were compared with those of a historical cohort of traditional in-person didactics based on the same topics. The historical cohort was enrolled in the OB/GYN clerkship from January 2022 to April 2022. Students who attended traditional in-person didactics did not have an NSVD simulation as part of their curriculum. In July 2022, the online modules replaced the traditional in-person didactics for those topics. Overall satisfaction scores for the overall obstetric curriculum were similarly obtained.

Prior to starting the obstetrics portion of the clerkship, students also participated in an NSVD simulation on a task trainer. The NSVD simulation was introduced into the curriculum at the same time as the online modules. It was not part of the clerkship curriculum prior to April 2022 and was conducted in the medical school. Students were required to complete the "Normal and Abnormal Labor" module prior to participating in the NSVD session. Eight to ten students participated per session. The first 10 min consisted of a brief demonstration on the task trainer of conduction of an NSVD. The remaining 30 min were focused on having each learner perform a simulated NSVD on the trainer. Students completed questionnaires before and after this simulation session assessing for level of confidence with the following steps of performance of an NSVD: delivering the fetal head, delivering the remainder of the fetal body, and delivering the placenta. Confidence levels were based on a 1–5 Likert scale (1 = not confident at all, 5 = very confident). These questionnaires, like the ones related to the online modules, were not standardized but were piloted from July 2021 to January 2022 with 60 students.

This study was exempt from Institutional Review Board review as this was an educational research study and no sensitive student information was being obtained. Neither verbal nor written consent for the review of grades was mandated by Icahn School of Medicine at Mount Sinai.

Statistical analysis

Data were retrospectively reviewed. Before and after scores were compared via paired *t*-test. Satisfaction scores associated with a *P*-value of <.05 were considered significant.

Table 1. Knowledge level before and after online module participation.

Topic	Pre-module	Post-module	<i>P</i>
Normal and abnormal labor	7.2 ± 1.5	9.2 ± 0.8	<.001
Intrapartum fetal heart rate tracings	8.1 ± 1.6	9.3 ± 0.8	<.001
Third-trimester bleeding/postpartum hemorrhage	7.4 ± 2.6	9.0 ± 1.5	<.001

Knowledge levels are presented as mean ± standard deviation. Maximum score was 10.

Results

Sixty medical student learners participated between April 1, 2022 and August 30, 2022.

Table 1 outlines knowledge scores before and after the online modules. Table 2 outlines comfort levels before and after the modules. Table 3 outlines confidence with various aspects of the performance of NSVD. Table 4 outlines satisfaction scores with the online modules, simulation session, overall obstetric curriculum, and traditional didactics.

For knowledge, pre-module scores ranged from 7.2 ± 1.5 to 8.1 ± 1.6 . Post-module scores ranged from range from 9.0 ± 1.5 to 9.3 ± 0.8 . Post-module scores were significantly higher than pre-module scores ($P < .001$). For comfort level pertaining to management, pre-module levels ranged from 2.4 ± 0.8 to 3.1 ± 0.9 . Post-module levels ranged from 3.8 ± 0.8 to 4.1 ± 0.6 . Post-module levels were significantly higher than pre-module levels ($P < .001$). Pertaining to confidence in performing steps of NSVD, pre-simulation confidence levels ranged from 1.6 ± 0.9 to 1.9 ± 0.7 . Post-simulation levels ranged from 3.9 ± 0.7 to 4.0 ± 0.8 . Post-simulation levels were significantly higher than pre-simulation levels ($P < .001$).

Satisfaction scores for traditional in-person didactics were significantly higher than for the online modules (4.7 vs. 4.4, $P < .001$). Sample size for the cohort exposed to traditional lectures was also 60. Satisfaction scores associated with the online modules indicated that they were favorably received. Mean satisfaction score for the NSVD simulation component was 4.8. Overall, satisfaction with the curriculum was 4.5.

Discussion

This article indicates that an obstetric curriculum consisting of online modules and simulation is associated with increased medical student learner knowledge, comfort, and satisfaction. Although satisfaction scores for the online modules were lower than those associated with traditional in-person didactics, they were still favorably received. This finding correlates with those published in the literature supporting medical student satisfaction with online modules in undergraduate medical education.

A search on PubMed and MedEd Portal yielded nine articles that demonstrated the utility of online modules in improving medical student knowledge and confidence after implementation of the electronic learning tool. Three of them

were based on topics in OB/GYN. Two of these three were focused on learners in the third-year undergraduate medical education. In one of these two studies, a 30-min online module was created as preparation for an objective structured clinical examination (OSCE) focused on pregnancy options counseling. The module began with background information related to unplanned pregnancy in the United States and concluded with a seven-step approach to nondirective pregnancy options counseling. In this study, 64% strongly agreed and 36% agreed that the online module helped them prepare for the OSCE.⁶ However, there were no data comparing OSCE performance or any other outcomes, such as knowledge, before after introduction of the online module.

In the other of these two studies, students enrolled in the OB/GYN clerkship were exposed to a set of three interactive learning modules that were focused on the following three topics: amenorrhea, vaginitis, and third-trimester bleeding. During these modules, students observed patient–physician interactions and were prompted to identify symptoms and alternative diagnoses by using photos, videos, graphics, animations, and text. There was no limit as to how long students could spend on each module, thus allowing students to learn at their own pace.⁴ Students had access to the modules 24 h a day, 7 days a week. Thirty-four percent of the students who completed the online modules reported that going through them prior to live lectures helped them to focus on the content being presented in-person. However, there were no data available indicating level of knowledge before and after completion of these modules and on comfort level pertaining to management of the conditions presented.

Our online learning modules assessed learner knowledge and comfort and demonstrated a significant increase pertaining to management of normal and abnormal labor, fetal heart rate tracings, third-trimester bleeding, and postpartum hemorrhage before and after completion. Additionally, our obstetric curriculum also included simulation.

Literature related to simulation in undergraduate medical education specifically related to obstetrics is also limited but the results are compelling^{5,7–10} In the study by Posner et al, students reviewed the steps in the performance of an NSVD on an obstetric simulator at the start of the clerkship and set up a

Table 2. Comfort level before and after online module participation.

Topic	Pre-module	Post-module	P
Normal and abnormal labor	2.6 ± 1.0	3.8 ± 0.8	<.001
Intrapartum fetal heart rate tracings	3.1 ± 0.9	4.1 ± 0.6	<.001
Third-trimester bleeding/postpartum hemorrhage	2.4 ± 0.8	4.0 ± 0.7	<.001

Comfort levels are presented as mean \pm standard deviation.

Table 3. Confidence levels with normal spontaneous vaginal delivery steps.

Step	Pre-simulation	Post-simulation	P
Determining fetal position	1.9 ± 0.7	3.9 ± 0.7	<.01
Delivering the fetal head	1.8 ± 0.8	4.0 ± 0.8	<.01
Delivering the remainder of the fetal body	1.6 ± 0.9	3.9 ± 0.9	<.01
Delivering the placenta	2.4 ± 0.8	4.0 ± 0.7	<.01

Confidence levels are presented as mean \pm standard deviation.

Table 4. Satisfaction scores.

	Satisfaction score
Normal and abnormal labor online module	4.4 ± 0.6
Intrapartum fetal heart rate tracings online module	4.3 ± 0.6
Third-trimester bleeding/postpartum hemorrhage online module	4.5 ± 0.6
Normal spontaneous vaginal delivery simulation	4.8 ± 0.5
Overall obstetric curriculum	4.5 ± 0.5
Traditional lectures	4.7 ± 0.5

Satisfaction scores are presented as mean ± standard deviation.

delivery tray prior to. They also learned how to deliver the placenta. This led to an improvement in confidence and knowledge base during the first days of the obstetric service. In a study by Nitsche et al that also evaluated the effect of vaginal delivery simulation on medical student education, third-year students participating in a vaginal delivery session rated self-perceived training adequacy and clinical preparedness at the end of the clerkship. Rating was based on a Likert scale (1 = inferior, 5 = superior). Students who received simulation training gave their preparedness an average rating of 4.0 as opposed to those who did not receive training giving their preparedness an average rating of 2.6.⁷ Neither of these studies assessed learner confidence for specific steps before and after participation in the simulation though. Our study specifically evaluated learner confidence in identifying fetal position, delivering the fetal head, delivering the remainder of the fetal body, and delivering the placenta. There was a significant increase in learner confidence in performance of each of these steps before and after participation in the simulation. This more than aligns with one of the Association of Professors of Gynecology and Obstetrics (APGO) Medical Student Objectives which is for students to be able to describe the steps of a vaginal delivery.⁸

There are several limitations associated with this study. One of them is the lack of data on the retention of knowledge over time and the associated reliance of an immediate pre-test and post-test design. Another limitation is lack of data regarding retention of skills relating to performance of a NSVD after participation in the simulation. A third limitation is lack of data assessing the effect of completion of the modules on National Board of Medical Examiners (NBME) Shelf Exam scores. A fourth limitation lay in assessing how participation in the NSVD simulation affected how students were able to conduct an NSVD on an objective structured assessment or on an actual patient. A fifth limitation is reliance on learner confidence (a very subjective marker) which are related to the two aforementioned limitations (the absence of more objective measures). A sixth limitation is the absence of a sample size calculation that would serve as justification for the sample size used

in this study. A difficulty encountered in enacting this curriculum lay in assuring that all students completed the online modules prior to starting the obstetrics portion of the clerkship.

Future directions for this study would involve having learners complete a questionnaire at the end of the clerkship assessing knowledge pertaining to the educational material presented in the online modules and conducting an OSCE relating to performance of an NSVD on a birthing mannequin. Assessing performance on a structured examination may be a better predictor of ultimate clinical performance. A study by Dayal et al in which students were randomized to simulation training and no simulation training and who were then evaluated on performance at the end of the clerkship attests to the feasibility of addressing this first direction. Dayal et al found that those students who received simulation training not only participated more actively in the clinical environment but also performed significantly better when evaluated on performance of delivery maneuvers on a mannequin simulator.⁹

A second direction would involve comparing NBME Shelf Exam Scores relating specifically to the topics presented in the online modules before and after the introduction of the obstetric curriculum. A third direction would involve re-introducing traditional in-person didactics and conducting a randomized controlled trial comparing knowledge and comfort levels between one group exposed to traditional in-person didactics only and another who completed online modules and simulation sessions before attending in-person lectures. A fourth direction would also involve conducting a randomized controlled trial but going on to compare knowledge and comfort levels between one group that completed the curriculum and another that did not complete it at all.

Nonetheless, this study supports the impetus for ongoing research focused on improving learner comfort early on in one's education, especially with more complicated deliveries, as research in this area is also limited. In a study performed by Alphonso et al that focused on medical student comfort with an obstetric emergency, 91% of the 54 students who participated agreed that the shoulder dystocia simulation was designed appropriately for their learning level and enhanced their ability to perform a complicated delivery. For the shoulder dystocia simulation, average overall rating was 4.24 on a 5-point scale (1 = poor, 5 = excellent). Students reported the simulation to be a positive and realistic experience. However, they participated in the simulation only at the end of the clerkship.¹⁰ In another study by Deering et al, medical students were surveyed at the end of their obstetrics rotation regarding their knowledge and comfort with basic obstetric procedures. The group of students who received simulation-based training on more advanced procedures, such as fetal scalp electrode placement, intrauterine pressure catheter placement, and artificial rupture of membranes, were significantly more comfortable in performing those

procedures than those exposed to standard resident and staff-directed instruction, thus further supporting the effectiveness of simulation incorporation.¹¹

The closest published study to this one though evaluated the impact of a simulation-based elective on medical student preparedness for OB/GYN residency. Students practiced procedural and surgical skills and honed their skills in diagnosis, management, and work-up of commonly seen problems using standardized patients and team-based training. Prior to and after completing the elective, student knowledge scores using the Preparation for Residency Knowledge Assessment tool significantly increased from 63.6% to 75.3%. Course evaluations and student feedback showed high satisfaction rates. However, this was an elective for students who had already completed the clerkship in OB/GYN.¹²

Conclusion

An obstetric curriculum consisting of online modules and simulation significantly increases medical student learner knowledge and comfort. The online modules are an appropriate alternative to traditional in-person didactics. This is especially noteworthy in light of the increase in utilization of online educational resources over the past 20 years and potential reliance on them in the occurrence of events necessitating remote learning. Moreover, findings from this study attest to the positive effect of a curriculum that incorporates both dissemination of information and simulation on learner knowledge and confidence. This is the first medical education report that provides links to well-received online obstetric modules tailored toward undergraduate medical education and can serve as a model for institutions focused on competency-based education during core clerkships.

Supplemental Material

Supplemental material for this article is available online.

REFERENCES

- Schumacher DJ, Englander R, Carraccio C. Developing the master learner: applying learning theory to the learner, the teacher, and the learning environment. *Acad Med.* 2013;88(11):1635-1645. doi:10.1097/ACM.0b013e3182a6e8f8
- Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Internet-based learning in the health professions: a meta-analysis. *JAMA.* 2008;300(10):1181-1196. doi:10.1001/jama.300.10.1181
- Kwant KJ, Custers EJFM, Jongen-Hermus FJ, Kluijtmans M. Preparation by mandatory E-modules improves learning of practical skills: a quasi-experimental comparison of skill examination results. *BMC Med Educ.* 2015;15:102. doi:10.1186/s12909-015-0376-4
- Obando C, Maurer J, Plantegenest G, Dokter C. The use of E-learning modules to improve student knowledge in obstetrics and gynecology. *MedEdPORTAL.* 2014;10:9920. doi:10.15766/mep_2374-8265.9920
- Posner G, Worth K, Nakajima A. An introduction to the management of labour and delivery—a simulation-based obstetrics workshop for medical students. *MedEd PORTAL.* 2012;8:9128.
- Lupi CS, Ward-Peterson M, Castro C. Non-directive pregnancy options counseling: online instructional module, objective structured clinical exam, and rater and standardized patient training materials. *MedEd PORTAL.* 2017;13:10566.
- Nitsche JF, Morris DM, Shumard K, Akoma U. The effect of vaginal delivery simulation on medical student education. *Obstet Gynecol.* 2014;123:117S.
- Association of Professors of Gynecology and Obstetrics. Medical Student Objectives, 11th Edition, 2019. <https://cdn.ymaws.com/apgo.org/resource/resmgr/apgo-11th-ed-mso-book.pdf>
- Dayal AK, Fisher N, Magrane D, Goffman D, Bernstein PS, Katz NT. Simulation training improves medical students' learning experiences when performing real vaginal deliveries. *Simul Healthc.* 2009;4(3):155-159.
- Alphonso A, Pathy S, Bruno C, et al. Shoulder dystocia and neonatal resuscitation: an integrated obstetrics and neonatology simulation case for medical students. *MedEd PORTAL.* 2017;13:10594.
- Deering SH, Hodor JG, Wylen M, Poggi S, Nielsen PE, Satin AJ. Additional training with an obstetric simulator improves medical student comfort with basic procedures. *Simul Healthc.* 2006;1(1):32-34.
- Lerner V, Higgins EE, Winkel A. Re-boot: simulation elective for medical students as preparation bootcamp for obstetrics and gynecology residency. *Cureus.* 2018;10(6):e2811.