A Multi-Phase Validation of the LiquidGoldConcept Lactation Simulation Model with University of Michigan Pediatric, Obstetric, and Family Medicine Residents: Results from Phase One

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Abstract

Background: As part of the University of Michigan obstetric, pediatric, and family medicine house officer lactation education project, the investigators assessed the LiquidGoldConcept Lactation Simulation Model (LSM) May 2017 prototype. This trial is the first time any LSM is validated for its use in comprehensive breastfeeding management training of residents.

Aims:
1. Validate LiquidGoldConcept Lactation Simulation Model Questionnaire
2. Assess look, feel, and realism of LiquidGoldConcept May 2017 LSM with first-year OB/GYN and Family Medicine Residents
3. Use participant feedback to improve look, feel, and realism of LiquidGoldConcept LSM

Methods: Six first-year OB/GYN residents and 11 first-year Family Medicine residents, participated in a 50 minute “Prenatal Breastfeeding Assessment” workshop during which they learned basic lactation physiology, used the LSM to practice a breast exam, and filled out the LSM questionnaire. A two-sample t-test was used to compare the means of two groups, with level of significance set at 0.05. Fisher’s exact test was used to quantify and compare the participant drawings of features to the true locations and sizes. A two-sample t-test was used to compare the observed means with zero, the distance from observed location to the base value.

Results: The average breastfeeding self-efficacy score among the 17 participants was a 3.91 out of 7, indicating a low level of confidence in breastfeeding knowledge and skills. On a Likert scale of 1 to 7, the May 2017 LSM received a mean score of 5.85 for overall realism of appearance, and 5.5 and 5.15 for the realism of the feel of breasts and nipples, respectively. Larger pathologies, freckles, scars, and nipple fissures were easily recognized. Improvement in the manufacturing technique is needed for smaller pathologies, nipple feel, and skin texture.

Conclusions: This unique university-industry collaborative validation trial provides a quantitative measure of the ability of the LiquidGoldConcept LSM to simulate normal breastfeeding states and common lactation problems.

Study Protocol

Trial 1
- OB/GYN
- Sample Size: n=6

Trial 2
- Family Medicine
- Sample Size: n=11

50 minute “Prenatal Breastfeeding Assessment” Workshop
1. Physiology Lecture
2. Breast Exam Demonstration (LSM)
3. Case Discussion (LSM)
4. 3-part LSM Validation Questionnaire

Lactation Simulation Model (May 2017 Prototype)

Validation of LSM Look, Feel, and Realism

Participant Documentations of Findings Analysis using FIGI/ImageJ

Aims: Evaluation of LSM Emulation

Table 1. Participant Demographics & Breastfeeding Background

Feature Correct (%) Size (mm) Location

Patient Demographics & Breastfeeding Background

- Gender
- Personal Breastfeeding Experience
- Breastfeeding Education Provision

Feedback

1. Rough Auxilary Area
2. Rubber/Hard Nipples
3. Nipple/Areola Coloring

Manufacturing Changes

1. Improved painting techniques and color palettes
2. Adding flat/inverted and bulbous nipple shapes
3. Casting new mothers’ bodies for future LSM generations

Table 2. LSM Improvements Made Based on Qualitative Data from Phase 1 Trial Feedback

Table 3. Participant Documentation of Findings Analysis using FIGI/ImageJ

Figure 1. Participants were not confident (3.91/7) in their ability to perform a prenatal breast exam and provide breastfeeding education to patients. Likert Scale: (1, strongly disagree; 7, strongly agree)

Figure 2. Overall, participants (n=17) agreed that learning with the LSM is comparable to learning from real patients. Likert Scale: (1, strongly disagree; 7, strongly agree)

Figure 3. Overall, participants (n=17) agreed that the LSM breasts and nipples look and feel realistic. Likert Scale: (1, strongly disagree; 7, strongly agree)

Figure 4. The majority of participants correctly identified a large plugged duct and a surgical scar. A minority of participants correctly identified smaller plugged ducts (upper/lower), the nipple crack or fissure, and the compressed nipple shape.

Figure 5. The majority of participants correctly identified a large plugged duct and a surgical scar. A minority of participants correctly identified smaller plugged ducts (upper/lower), the nipple crack or fissure, and the compressed nipple shape.

Validation of Manufacturing Intent

Identification of Superficial and Deep Pathologies

<table>
<thead>
<tr>
<th>Feature</th>
<th>Correct (%)</th>
<th>Size (mm)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Plugged Duct</td>
<td>64.7%</td>
<td>0.000005*</td>
<td>0.007251*</td>
</tr>
<tr>
<td>Upper Plugged Duct</td>
<td>11.7%</td>
<td>0.2207</td>
<td>0.02076*</td>
</tr>
<tr>
<td>Lower Plugged Duct</td>
<td>23.5%</td>
<td>0.4055</td>
<td>0.06902</td>
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<tr>
<td>Crack</td>
<td>29.4%</td>
<td>0.3796</td>
<td>0.08</td>
</tr>
<tr>
<td>Scar</td>
<td>64.7%</td>
<td>0.4919</td>
<td>0.0005*</td>
</tr>
<tr>
<td>Nipple Shape</td>
<td>11.7%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 (above) and Figure 6 (right). Investigators used FIGI/ImageJ software to determine whether participants documented findings on the breast line-drawing correctly. Only the large and upper plugged ducts and scar were consistently correctly identified by participants.

Conclusions

- Integrating the LSM into the resident lactation curriculum and providing more hands-on learning opportunities may improve resident confidence in breastfeeding skills.
- Feedback from participants suggests that non-essential features (skin texture, areola area, nipple feel) need refinement to reduce distraction and erroneous findings.
- Future studies will validate knowledge and skills acquisition, retention, and transfer to patient care.

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Table 1. With the exception of gender, participants in both trials were similar. P-value greater than 0.05 indicates that the two groups are comparable.