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Evaluation of an educational board game to improve use of the partograph in sub-Saharan Africa: A quasi-experimental study

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ABSTRACT

Background: The partograph is a tool used to record labour observations and support decision-making. Although used globally, it has not reached its full potential. We aimed to determine whether an educational board game can improve labour-monitoring skills and influence practice.

Study design: A quasi-experimental study, underpinned by Kirkpatrick's evaluation model, was used. Midwives and student midwives from Malawi, Kenya and Tanzania were given an identical hypothetical case-scenario of a woman in labour pre-and post-implementation of a game, to assess recording and interpretation abilities. This was supplemented by qualitative inquiry 3 months post-game-playing using semi-structured interviews (n = 24) and expert case-record reviews (n = 24). Quantitative data were analysed using the paired *t*-test and qualitative data were subjected to framework analysis.

Results: 95 midwives and 97 students participated. In each country the mean test scores improved; Kenya from 86.5 (6.7) to 95.5 (3.7) (paired t = 11.82, $p < 0.001$), Malawi from 83.6 (6.7) to 94.6 (4.1) (paired t = 13.35, $p < 0.001$), and Tanzania from 83.8 (6.2) to 94.9 (4.1) (paired t = 15.27, $p < 0.001$). Qualitative findings revealed six themes: 'an enjoyable way of practicing,' 'learning and re-learning,' 'improved clinical decision-making', 'promoting team-work', 'a catalyst for additional learning' and 'barriers to transference of learning'. Expert case-record review demonstrated good adherence to recommendations.

Conclusion: Board games have the ability to improve labour-monitoring knowledge. Retention of information was apparent and application of learning into practice was encouraging. Health-system barriers need to be resolved for midwives to apply theory to practice. Whether such application results in improved clinical outcomes is uncertain and requires further evaluation.

Introduction

Globally, prolonged and obstructed labour is a major cause of maternal death and morbidity [1]. Although mortality rates resulting from this complication has declined since 1990, the World Health Organisation (WHO) estimates that between 50,000 and 100,000 women still develop obstetric fistulae due to obstructed labour annually and that around two million women are currently living with this disorder [1]. These devastating consequences are largely preventable [1,2].

The globally accepted labour monitoring tool is the partograph, originally designed for use in low-resourced settings to identify and manage prolonged labour [3]. By providing a graphical representation of labour progress along with records of maternal and fetal condition it can alert professionals to deviations from normal and prompt action to optimize clinical outcomes for the mother and baby. Although used for over 40 years, the partograph has not reached its full potential [4], often being used incorrectly, if at all. Using the partograph can be challenging in practice [5,6] and so there is a need to motivate and assist midwives to use this tool effectively. A realist review, of 95 papers, suggested that the partograph's failure was due partly to a lack of appropriate training [7]. This has prompted some to explore innovative ways to teach labour monitoring [8].

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In recent years game-based learning has been used extensively in the health sector. It has been claimed that this approach can foster learning and expand skills in an interactive and fun environment [9]. Students have been motivated and encouraged to learn in a non-threatening environment [10]. In various types of health professional education, games allow learners to make mistakes and learn from them without endangering lives [9]. Several games have been included in the WHO Midwifery Education Modules which have been used globally [11]. Educational board games have been used in high [12] and low income [13] settings, valued for being cost-effective [16]; encouraging critical-thinking [14] and promoting behaviour change [15].

Theoretical model

Kirkpatrick's four-level model [16] underpinned this study. This model allows a staged approach to evaluation, which commences with an initial low cost assessment, which is built upon in three later stages. This approach has been used successfully in similar studies [17] and remains relevant due to its simplicity as an operational framework [18].

In level one, initial views were sought to determine game acceptability and potential relevance to clinical practice. Kirkpatrick recommends that all training is evaluated at this level to enable adjustments to be made. Participants' feedback at this level informed the second level which determined whether learning had taken place, after game-playing, and to what degree. The level two evaluations used before-training (pre-test) and after-training (post-test) assessments, moving the evaluation beyond participant acceptability to an assessment of knowledge and skill-development. Level three built on level two to explore whether the knowledge and skills are transferable from theory to practice. Level four assesses whether the game improves clinical outcomes; we have not reached this level. In this paper, we report on levels two and three.

Intervention

An innovative board game was designed to develop the skills required to employ the partograph effectively with the ultimate aim of making birth safer for women. The game [19], which focused on charting and interpreting the partograph, was initially field tested in 2014 at a workshop in Zambia with participants from six African countries (Kenya, Malawi, Tanzania, Uganda, Zambia, Zimbabwe). This stage confirmed game acceptability and enabled its further development. The game, named 'Progression', required charting and interpreting a series of findings pertaining to one woman's labour. *Practice Cards* emphasised issues of good and bad practice, whilst *Question Cards* gave opportunity for participants to test their knowledge, revise learning and discover new facts. The game was designed to be fun and educational; an element of chance made it possible for anyone to win, thus facilitating a non-threatening learning environment.

Methods

Aims

This study explored the views, experiences and skill-development of midwives and student midwives on using educational board games to improve their labour-monitoring abilities.

Design

A quasi-experimental design was used followed by qualitative inquiry and expert review.

Setting

The study was a collaboration between three Universities in sub-Saharan Africa; [name of Universities]. Students were recruited from these universities. Midwives were recruited from the affiliated public or faith-based hospitals; tertiary, district and community hospitals were included.

Participants

Participants were qualified midwives and student midwives undertaking the Bachelor of Science Nursing degree which incorporates a placement in the maternity unit. Theory related to labour care is primarily taught using traditional lectures to large cohorts of students, with minimal opportunities for interactive learning. In Malawi, Kenya and Tanzania midwifery education is incorporated into nurse training. A purposive sample of students, in their final year of training, who had already experienced a maternity placement, was invited based on their availability during the study period.

The qualitative sample was purposively obtained from the qualified cohort who participated in the quasi-experiment. A maximum variation sample was chosen from those participants who volunteered to be interviewed.

Sample size

The sample size for the quasi-experiment was determined, using the assumption, based on previous work [20] that 50% of partographs will be correctly completed. For 5% significance and 80% power, 96 participants were required to detect a 10% improvement; this would be clinically significant.

Qualitative exploration: To assess transferability of learning, from the 'classroom' to the clinical environment, we followed a sub-group of participating midwives (n = 24) for 3 months post-game playing.

Expert review: We drew on the expertise of senior local midwives and obstetricians to review a random sample of participant case records, post-game implementation. A purposive sample of stakeholders were invited to participate (n = 6; 1 senior midwife and 1 senior obstetrician per country).

Recruitment

Midwives were recruited at the participating hospitals via invitation letters. All potential participants were supplied with written and verbal study information by the project team. Participants were informed that participation was voluntary and were given a minimum of 24 h to consider taking part. For pragmatic reasons, students were verbally invited to participate by a team member outside their organisation, during a scheduled class. They were also given a participant information sheet. None of their University's faculty members were present during recruitment. Students were told that their participation would not influence their future teaching.

For all participants written consent was obtained at each stage.

Data collection

This was a pragmatic study utilising a sequential mixed-methods design [20], using 3 data sources.

A quasi-experiment was used to determine skills pre- and post-game playing using an uncontrolled before-and-after design. To ensure that any observed changes were attributable to game-playing and to observe the environment's stability, we actively searched for any changes in care-delivery and observed current partograph training practices during the study period. Following written consent, participants completed a demographic questionnaire and were given a *blank modified WHO partograph* [21] and written case scenario describing a woman's labour. Participants were requested to complete the partograph, based on the case scenario. We used a marking grid, validated in an earlier study [17] for consistency, and adapted for the current study. A score of 80

was given for recording and 20 for interpretation. Two assessors were used to protect against interpreter bias. The post-test was carried out one month after game-playing, using the same partograph, case scenario and marking grid. This provided us with our main outcome of interest, i.e. the differences in percentage scores before and after game-playing.

We used a qualitative interpretivist epistemology to explore the experiences of participants, who took part in the quasi-experiment. A further information sheet was provided and written consent sought. We used semi-structured interviews, the interview schedule being informed by previous experience, expert opinions, and current literature. Interviews were undertaken 3 months after game-playing, conducted by a LAMRN researcher and lasting between 30 and 90 min. In Kenya and Malawi individual interviews took place. For logistical reasons, Tanzania chose to undertake a focus group interview. Interviews were audio-recorded and transcribed verbatim.

Each expert reviewed 4 case records, chosen at random from recent cases that midwives had been the lead caregiver during a woman's labour. Experts were provided with a structured checklist to record partograph entries and appropriateness of actions in accordance with WHO guidelines [22] and International Confederation of Midwives competencies [23].

Analysis

Quantitative data were entered onto an IBM SPSS database (version 23) for descriptive and comparative analysis. Scores were compared pre- and post-intervention using a paired *t*-test overall and separately for each country. To compare students' scores with midwives' scores an unpaired *t*-test was used.

Qualitative data were transcribed verbatim and an interpretive approach to analysis conducted. We adopted the Framework Approach [24] which allows for inclusion of a-priori as well as emergent concepts. Analysis proceeds from familiarisation with the data, through identification of a thematic framework, indexing, coding, charting and interpretation. This approach allows researchers to find associations and provide explanations, as determined by the themes emerging from the data and the research question. A sample of transcripts was independently coded by two people. Data display was facilitated by word-processing but analysis was conducted manually. Box 1 provides an example of one of the categories from the final theoretical framework, 'Learning and re-learning'.

Ethical consideration

Full ethical approval was obtained from the participating Universities. Participants were assured that confidentiality and anonymity would be maintained and codes replaced their names. Participants' right to decline or withdraw at any time was conveyed to them by a researcher from the same cultural background.

Table 1
Midwives' and student midwives' demographics.

		Tanzania	Malawi	Kenya
Age, Mean (SD)	Midwife	36.4 (7.1)	39.1 (5.8)	42.0 (5.5)
	Student midwife	21.4 (0.9)	21.2 (0.8)	21.9 (0.7)
Years of experience, median (range)	Midwife	8 (1–29)	9 (4–25)	12 (4–27)
	Student midwife	N/A	N/A	N/A
Gender				
Male	Midwife	5	3	0
	Student midwife	6	7	6
Female	Midwife	28	29	30
	Student midwife	27	25	26

Results

Pre and Post-intervention results

We recruited 95 qualified midwives and 97 students across the 3 settings. Tanzania included 33 midwives and 33 students, Malawi included 32 midwives and 32 students and Kenya included 30 midwives and 32 students. The baseline details are included in Table 1.

When all countries were combined, the pre- and post-intervention scores showed a statistically significant improvement in means (SD), from 84.1 (6.2) to 94.7 (4.0) (paired $t = 21.18$, $p < 0.001$; 95% CI for mean difference 9.64–11.62). The biggest improvement was in interpretation, with an increase in mean score from 10.3 (3.5) to 16.1 (2.8) (paired $t = 17.28$, $p < 0.001$; 95% CI for mean difference 5.18–6.52).

Pre- and post-test scores, by country, can be seen in Table 2, highlighting that improvements in scores were identified in each country and by each sample group.

In the pre- and post-test evaluation, students' scores were significantly higher than those of the midwives (Table 3).

Midwives experiences at 3 months

To explore the longer-term impact of game-playing on practice, interviews were conducted 3 months after game-playing with qualified midwives. Each country included 8 midwives, purposively sampled from those who had volunteered.

All midwives remembered the games and were able to recall specific scenarios, question cards and interactions. Midwives gave positive feedback, confirming game acceptability. Six key themes, common to all countries, were generated and have been presented as a whole.

Box 1
Example of charting.

Learning and re-learning	
Refreshing one's knowledge	*The game reminded us of some knowledge we had forgotten* (Line 216)
New learning	*I learned something because I did not really know the partograph but after the game it was obvious* (Line 322-323)
Reflective learning	*Up to this moment I do remember the scenario and don't think that I will leave such women without required care* (Line 98-99)

Table 2
Pre and post intervention scores.

	Tanzania n = 66				
	Scores, mean (SD)		Pre versus post-test score		
	Pre-test	Post-test	Paired t	P value	95% CI for mean difference
Midwives	83.4 (7.1)	93.4 (4.8)	8.61	< 0.001	7.71–12.48
Students	84.1 (5.2)	96.4 (2.6)	14.34	< 0.001	10.48–13.94
Total score	83.8 (6.2)	94.9 (4.1)	15.27	< 0.001	9.69–12.61
	Malawi n = 64				
	Scores, mean (SD)		Pre versus post-test score		
	Pre-test	Post-test	Paired t	P value	95% CI for mean difference
Midwives	80.1 (6.2)	92.7 (4.7)	9.92	< 0.001	10.0–15.18
Students	87.1 (5.1)	96.5 (2.3)	9.52	< 0.001	7.34–11.35
Total score	83.6 (6.7)	94.6 (4.1)	13.35	< 0.001	9.33–12.61
	Kenya n = 64				
	Scores, mean (SD)		Pre versus post-test score		
	Pre-test	Post-test	Paired t	P value	95% CI for mean difference
Midwives	86.3 (5.9)	93.0 (2.7)	5.57	< 0.001	4.26–9.20
Students	86.6 (4.4)	97.8 (1.5)	14.01	< 0.001	9.61–12.89
Total Score	86.5 (5.2)	95.5 (3.2)	11.82	< 0.001	7.53–10.60

An enjoyable way of learning

Participants enjoyed playing the game, saying that it 'was not boring' and suggesting that it was a 'fun way of practicing' in a supportive environment. Its interactive nature was particularly valued:

> "We were like practicing when playing the game and you know more because when playing the game you learn faster than someone explaining it to you…if you are actively involved playing that game you know more" [Malawi]

Participants were enthralled by the game, and, as observed during the game-playing 3 months earlier, were disappointed when they had to stop [field notes]:

> "It's very addictive…. it's enjoyable and a good thing to do. At some point you would see that time is out but you don't want to stop." [Kenya]

Participants related the game directly to practice; highlighting examples of how it has impacted on the care they now give:

> "It's like you were putting in practice what we do at work. It's like you are having a woman having an obstetric emergency. So once we are playing it was giving us a reminder that once we meet that woman maybe in labour or at antenatal clinic you need to assess and do a referral". [Malawi]

Learning and re-learning

Playing the game was valued for teaching participants something new related to intrapartum care and for refreshing midwives on areas they had previously learnt:

> "The game reminded us of some knowledge we had forgotten, we learnt new things and it gave us new updates." [Kenya]

Importantly, participants were proud of what they had learnt and how it had changed their behaviour towards the partograph:

> "I used to think it was a time waster but now I like it …. even now I fill in my Parto's [partographs] without hesitation and report my findings proudly." [Tanzania]

One of the lessons learnt during the game-playing was the relationship between the observations recorded and subsequent care provided:

> "I can say several issues seemed quite new. For instance, information about fetal distress and its relationship to dehydration of the women was new to me." [Tanzania]

Participants had reflected on the scenarios that had been used within the game to apply to their clinical practice:

> "I still remember some of them. One was about a woman with meconium stained liquor where we were given a penalty because the card read that we did not do any action after seeing such a woman. After the game I revisited my old notes on what to do with such women…… I remember the scenario and don't think that I will leave such women without required care." [Tanzania]

Improved clinical decision-making

One partograph aim is to support clinical decision-making during labour. The game was developed to support this, by challenging participants on their clinical choices. It was rewarding to see that, 3 months after game-playing, practice had been influenced:

> "I was able to diagnose obstructed labour early and with the knowledge what we have learnt from the cards we have been able to implement the charting of the partograph and it really helped us in the interpretation of the partograph." [Kenya]

Participants were able to provide specific examples of how their learning was translated into better care for a woman in labour. One midwife, from Malawi, discussed a woman who had failed to progress in labour. She stated that her 'new knowledge' helped her recognise obstructed labour prompting her to refer the woman. Others suggested that they had grown in confidence and are more efficient:

> "Personally I have improved on my decisions to clients and advise the doctors if C/S is needed and other issues – I write my reports quickly without wasting too much time." [Tanzania]

Table 3
A comparison of midwife versus student midwife scores.

	Students N = 97 Mean (SD)	Midwives N = 95 Mean (SD)	Students vs Midwives Unpaired *t*-test	P value	95% CI for mean difference
Pre-test	85.94 (5.0)	83.19 (6.8)	t = 3.18, df 190	0.002	1.0–4.5
Post-test	96.89 (2.3)	93.06	t = 7.97, df 190	< 0.001	2.8–4.8

Promoting team-work

As the game is team-based, discussions between players is encouraged. Observing participants playing the game, demonstrated a high level of interaction, which participants believed reflected the situation in the clinical arena.

> "Like in health you need to interact with friends or fellow workers that you are working together, you need to work in team spirit….So interaction was one of the things that I liked. It was teaching us that we should work in a team, as a team." [Malawi]

Participants were from different facilities which added to the discussions around responses to questions, each participant drawing on their own experiences and enabling critical dialogue:

> "We got to know what they do in some facilities that we didn't do in ours and the reward was so interesting, it was so nice." [Kenya]

A catalyst for additional learning

Many participants reflected on their own knowledge, after playing the game, and as a consequence sought additional information:

> "One time I had forgotten the answer to a question about inadequate uterine activity…I revisited my school notes after the game." [Tanzania]

Some participants, especially those in senior positions, felt embarrassed that they did not always know the correct answers:

> "I am not able to answer a single question but deep within me I will say I thought that I knew this and I don't know, so after this I will make sure that I read every time and get to know so that in case of anything or I am asked by a junior then I will be able to answer." [Kenya]

Once identifying deficits, participants would seek further information through reading literature or by revisiting the game:

> "[I] felt embarrassed at first when I failed to interpret the partograph situations I plotted. I am a senior person but had difficulties to interpret… After the second game play now I feel comfortable." [Tanzania]

Participants also cascaded their learning by encouraging other colleagues to play the game, in the health facility:

> "I came back to my work place and shared with the team and several mornings before we go to the patients we shared a scenario and every person during that session had to plot the partograph…. " [Kenya]

Barriers to transference of learning

Although participants were motivated to implement what they had learned, they were sometimes frustrated that the clinical environment had barriers that prevent this from happening. Staff shortages, for example, hindered participants from doing a comprehensive assessment:

> "You want to have a proper assessment for the woman but you find that maybe in labour ward there are five or six patients, one is delivering, you want to assess another woman, so I think some of the time you find that it's challenging when you find out that maybe that woman was having an obstructed labour." [Malawi]

Participants also discussed equipment shortages which prevented them from completing the partograph fully:

> "We learnt the importance of taking temperatures but sometimes there are no thermometers to do this." [Tanzania]

Some participants also described wider health-system problems. For example, one participant alluded to the fact that even when a complication is identified, this does not guarantee appropriate care:

> "Sometimes maybe there is delay in the referral system.…the patient will need the next level of care but you are still remaining with that patient maybe for some hours just because of delayed transportation and sometimes you don't give your services properly to the clients just because of pressure … four months ago we had expired Magnesium sulphate." [Malawi]

Expert review

Two experts reviewed 4 case-notes from each country to assess participating midwives' partograph skills in practice; 24 case notes were reviewed in total. A maximum score of 41 was possible; 31 marks were allocated for completing the partograph and 10 for correct interpretation. The scores demonstrated a proficiency in completing and interpreting the partograph, as indicated in the mean percentages (Table 4).

All participants scored 10/10 (100%) for their interpretation of the partograph. All marks lost were due to incomplete recording. This was mainly related to maternal pulse not being recorded but was also due to observations not being carried out as often as recommended.

Discussion

This study aimed to determine whether playing an educational game is beneficial for learning partograph skills. Participants indicated that they enjoyed playing the game, acknowledging the potential to increase knowledge and improve clinical care. Like others [25] they particularly liked the interactive team approach to learning, suggesting that clinical discussions during the game mirrored the dialogue amongst health professionals in the clinical environment. Interaction and team education has been noted as key components of deep learning [26].

Whilst computer-gaming is growing in popularity [27] to support health education, it is clear that traditional board games also have their place. In fact, although some students suggested transferring the game onto an online platform, the majority liked its transportability into the clinical setting and had concerns related to internet connectivity. Furthermore, playing on-line would limit the team interaction, which was valued by participants.

Pre-test scores amongst all participants were relatively good, with no group scoring a mean percentage of less than eighty. This may be because those most motivated to learn were also most likely to volunteer to participate in the research. It could also be, as suggested by the qualitative responses, that in practice 'short cuts' are taken, influenced by the challenges of working in under-resourced, busy clinical environments. In the research environment participants were likely to have felt less pressure.

Pre-test results identified that many points were lost due to participants' inability to interpret the data that they had recorded.

Table 4
Expert review scores of completing the partograph in practice.

	N	Mean (%)	Standard Deviation
Tanzania	8	87.3	5.0
Kenya	8	89.0	4.8
Malawi	8	91.6	4.9
Combined score	24	89.3	5.0

Interpretation of the partograph has been highlighted by researchers as a key area were training is inadequate [7]. The qualitative findings suggest that prior to game-playing participants viewed the partograph as merely a tool to record labour information. Following game-playing, participants had begun to consider the partograph as a decision-making tool. Being able to connect the different observations to create a holistic picture on which to base clinical care was reassuring. The fact that midwives were still reflecting on the case scenarios three months after game-playing provides some evidence of the sustainability of the lessons learnt. This was further reinforced by the expert case-record review, where full marks were scored for interpretation.

Student scores were higher than midwife scores in the pre- and post-test. These findings probably reflect the fact that students would have received some recent training on the partograph during their undergraduate course. Conversely, midwives in these countries, rarely have access to continual professional development.

Quasi-experimental designs have recognised limitations due to internal validity threats [28]. We cannot be certain that the improvements identified were solely due to game-playing due to the uncontrolled before-and-after design [29]. The qualitative findings, for example, suggest that the game prompted midwives to seek further practice-related information which is likely to have contributed to improved scores. We did, however, try to minimise any threats by ensuring that participants were typical of the wider target population (age, gender, years' experience) and actively observing any training during this period. We also conducted the pre-and post-test under the same conditions and coordinated by the same researchers. Nevertheless, randomised controlled trials remain the gold standard for testing interventions [30]; to enhance rigour, future studies should consider incorporating a control group of participants who do not play the game.

Using different data collection methods to observe practice changes strengthened this study. The qualitative enquiry suggested that participants retained the knowledge gained, and importantly cascaded this to others; this was reinforced by the expert review. Individuals highlighted examples of how their practice had improved, reinforcing the notion that board games may go beyond simple awareness raising [15]. These findings also highlight that despite gaining increased knowledge and skills, some participants were hampered by existing processes, practices and resources. Health-system barriers need to be resolved for health professionals to apply theory to practice.

An important message for educators is that board games can provide an innovative way of teaching complex clinical subjects in a fun, interactive, non-threatening and cost-effective way.

Conclusion

This study provides some confidence that educational board games have the potential to support clinical practice. In resource-limited settings this approach provides a low-cost way of educating large numbers of health professionals in a way that they can easily relate to practice. Importantly, the knowledge gained during game-playing remained with midwives beyond the immediate period and there was some evidence that this was translated into care-provision.

Funding source

The Laerdal Foundation.

Conflict of interest

There are no conflicts of interest.

Ethical approval

Approvals were gained from the Universities of Nairobi, Manchester and Malawi and Catholic University of Health and Allied Health Sciences.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.srhc.2019.03.001.

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