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Rater training for standardized assessment of Objective Structured Clinical Exams in rural Tanzania

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Key Words Simulation Training, Community Child Health, Resuscitation, Mortality, Medical Education

Word Count: 2928

Abstract:

OBJECTIVES

To describe a simulation rater training curriculum for Objective Structured Clinical Exams (OSCEs) in Tanzania.

BACKGROUND

Rater training for OSCE evaluation is widely embraced in high income countries (HIC) but not well described in low and middle-income countries (LMICs). Helping Babies Breathe (HBB), Essential Care for Every Baby (ECEB) and Bleeding after Birth (BAB) are standardized training programs that encourage OSCEs evaluations. Reports of the reliability of these assessments is rare, making score inferences vulnerable.

METHODS

Training using these programs was conducted over three days. Healthcare providers scored selected OSCEs role played using standardized learners and low fidelity mannikins; proficiency levels were determined *a priori*. Zabar's review criteria guided rater feedback in score review. Descriptive statistics and Fleiss' kappa provided information about rater agreement. Challenges were tracked with field notes.

RESULTS

Six healthcare providers scored 42 training scenarios. Fleiss' kappa value shows moderate levels of rater agreement with 'poor' and 'acceptable' proficiency across all OSCEs (κ=0.508, p<0.001). Kappa values increased with HBB (κ=0.28 to 0.48), and ECEB (κ=0.42 to 0.77) by Day 3 of training but not with BAB (κ=0.58 to 0.33). Raters identified average proficiency 50% of the time. OSCE items with multiple steps challenged our in-country raters.

CONCLUSION

Our study shows in rural, Tanzania, training of in-country raters is feasible and effective. All countries and regions should have their own trained OSCE raters. Rater training is critical to ensure that the potential of training programs translates to improved outcomes for mothers and babies.

BACKGROUND

Helping Babies Breathe (HBB) and Essential Care for Every Baby (ECEB), from the Helping Babies Survive Program[1,2] and the Bleeding after Birth (BAB) from the Helping Mothers Survive (HMS) program[3,4] are examples of standardized health provider training programs designed by expert clinicians and educators from high income countries (HIC) with input from low and middle income countries (LMICs) for use in LMICs. The HBB training course reviews skills related to newborn resuscitation; ECEB focuses on newborn routine care and danger sign identification; BAB reviews management of maternal hemorrhage. All three courses and others in the HMS, HBS series, use low-fidelity mannequins, hands-on simulation practice of common case scenarios and emphasize compliance with algorithm-based 'Action Plans'. Course content addresses common gaps that lead to some of the highest sources of global maternal[5,6] and newborn mortality. [1,2]

Helping Babies Breathe, ECEB and BAB workshop participants are frequently assessed using Objective Structured Clinical Exams (OSCEs). A number of studies in a variety of LMIC settings have demonstrated improvements in provider competency managing relevant obstetric and neonatal cases post training.[6-16] However, few of these studies provide details OSCE assessment reliability.[10,15,16] Furthermore, only one study used in-country OSCE raters;[15] others rely on external (from outside the country of study) development and academic partners serving in rater roles.[9,16]

Training of raters to serve as OSCEs assessors is widely embraced in HIC,[17-25] but rater training has not been well described in LMICs. Reisman and colleagues refer to standardized OSCE training but do not report details.[15] Formal pre-OSCE training for assessors aims to minimise sources of measurement error, [17-25] increasing confidence that a participant's OSCE

score truly reflects their competence. With OSCE administration, sources of error can arise from the OSCE structure and/or rater objectivity.[17,19,22,25] Facilitator materials for HBB, ECEB and BAB courses provide clear guidelines to minimise measurement error with the OSCE administration. For example, Jhpeigo provides information on quality assessment[3] for their HMS training series, but there are no guidelines for training OSCE raters or evaluating rater agreement. The importance of reporting on the reliability and validity of scores with OSCE administration has been well described,[17-25] with only one study providing information on rater agreement using in country assessors in an LMIC.[10] The purpose of our study was to describe a simulation-based OSCE rater training curriculum and assessment of subsequent levels of rater agreement with administration of OSCEs in rural Tanzania using locally trained healthcare providers as raters.

METHOD

This study was embedded within a Simulation Enhanced Maternal Newborn Health training workshop. The study was approved by Catholic University of Health and Allied Sciences Ethics Board (#CREC/070/2015), the Tanzania National Institute for Medical Research (NIMR) (#MR/53/100/525), and University of Calgary Science and Ethics Board (#REB15-1919).

Patient and Public Involvement

Patients were not involved in this study.

Setting

The study was conducted in Kwimba District located in Mwanza Region, Tanzania over two days in April 2018 and one day in May 2018.

Participants

Raters were recruited from amongst rural health facilities in the district where training was to occur. Selection was based on their demonstrated proficiency in previous Newborn Maternal

training workshops and their experience as obstetrical health providers. All selected participants provided informed consent to be involved in the study. Rater characteristics and Rater OSCE scores for each OSCE scenario were collated under a master tracking number to ensure rater anonymity. Following three days of rater training, participants were involved as raters for OSCE evaluations to assess workshop learners pre and post training, at 6 and at 12 months. The rater training curriculum was led by a team comprised of clinician researchers from Catholic University of Health and Allied Sciences (CUHAS) and University of Calgary.

Design

This study used a descriptive study design (Figure 1). Scenario proficiency (poor, acceptable and excellent) was decided *a priori*, and role modelled by clinician research team members to create a mock scoring context. Each participant selected to be a rater independently scored each scenario. Raters made their own judgements of observed behaviours without consulting colleagues. Checklists were collected and collated on an MSExcel spreadsheet on a research dedicated computer. Field notes were used to track challenges. SPSS version 26 was used to analyse rater data. Descriptive statistics were used to provide information about mock scoring and raters abilities to identify the three categorical levels of proficiency. All raw scores indicating excellent levels of proficiency (Table 2) were also analyzed as acceptable (Table 3) to align with training program guidelines; two categories of proficiency. Fleiss' Kappa was calculated to provide information about the level of rater agreement.[27] Kappa values of <0.20, 0.21-0.40, 0.41-0.60 and 0.61-0.80 and 0.81to 1.00 are considered poor, fair, moderate, good, and very good respectively.[27]

Evaluation Tools

The OSCEs used were drawn from training program materials.[1-4] There were 24 pass/fail items on the HBB OSCE, 15 items on the ECEB OSCE and 14 items on the BAB OSCE. All raters were familiar with the OSCE checklists and relevant training course content as they had recently participated in the same courses themselves as learners. Poor proficiency, often referred to as 'red' in reported studies was identified by a score of <71%; 0-17, 0-10, and 0-9 on the HBB, ECEB and BAB OSCE, respectively. Learner scores >70% identified an 'acceptable' level of proficiency or 'green' in reported studies; >17, >10, & >9 on HBB, ECEB and BAB respectively.[1-4] The Research team added a third category, a candidate's score of >22, >13 and >12 identified excellent proficiency for HBB, ECEB and BAB OSCEs, respectively.

The Rater Curriculum

The conceptual framework (Figure 2) and Zabar's review criteria[28] provides details about elements of the curriculum and the iterative nature of the training process. Three physical OSCE stations were set up to facilitate learner transition between each testing station.

RESULTS

Raters (*n*=6) included physicians (*n*=1), midwives (n=4) and nurses (*n*=1); all study participants completed the three full days of rater training. They scored a total of 42 scenarios over the three days of training. Table one provides details about scenario scoring for HBB, ECEB and AMSTL over the three days.

Table 1. Kappa values with significance ($p<0.05$)

Training Program	Proficiency Level	n	Average		Day 1 (n=16)		Day 2 (n=14)		Day 3 (n=12)	
			Fleiss' K	p value	Fleiss' K	p value	Fleiss' K	p value	Fleiss' K	p value
HBB		15	0.43	p<0.05	0.28	p<0.05	0.58	p<0.001	0.48	p<0.001
	Poor	2	0.32	p<0.001						
	Acceptable	13	0.32	p<0.001						
ECEB		12	0.61	p<0.05	0.42	p<0.001	0.70	p<0.001	0.77	p<0.001

	Poor	2	0.63	p<0.001						
	Acceptable	10	0.63	p<0.001						
BAB		15	0.46	p<0.05	0.58	p<0.001	0.19	NS	0.33	p<0.05
	Poor	6	0.42	p<0.001						
	Acceptable	9	0.38	p<0.001						
All OSCEs		42	0.508	p<0.05						

The time needed for each OSCE station with score review was longer for average proficiency levels (30-40 minutes) when compared to 'excellent' and 'poor' proficiency levels (15-20 minutes). Fleiss' Kappa values (Table 1) showed that there was a moderate level of rater agreement in identifying 'poor' and 'acceptable' proficiency across all OSCEs (κ=0.51 p<0.001). Kappa values improved over the three days moving from 'fair' to 'moderate' for the HBB OSCE and 'moderate' to 'good' for the ECEB OSCE. The kappa value for BAB was 'moderate' Day 1 but decreased to 'fair' Day 2 and Day 3. Except for the kappa value for BAB Day 2, all kappa values were statistically significant (p<0.05). Information about rater abilities to correctly identify proficiency levels is described in Table 2 and 3.

Table 2. Proficiency level identification with excellent category (Number of scenarios and resulting percentage correctly identified in proficiency category)

OSCE	Proficiency Level	n	Rater 1	Rater 2	Rater 3	Rater 4	Rater5	Rater 6
All		42						
	Poor	10	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)	9 (90%)
	Average	18	8 (44%)	9 (50%)	9 (50%)	5 (28%)	8 (44%)	8 (44%)
	Excellent	14	10 (71%)	7 (50%)	10 (71%)	8 (57%)	11 (79%)	10 (71%)
BAB		15						
	Poor	6	6 (100%)	6 (100%)	6 (100%)	6 (100%)	6 (100%)	5 (83%)
	Average	3	2 (66%)	0 (0%)	0 (0%)	0 (0%)	2 (66%)	2 (66%)
	Excellent	6	3(50%)	1 (17%)	3 (50%)	2 (33%)	5 (83%)	3 (50%)
ECEB		12						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	6	0 (0%)	3 (50%)	3 (50%)	1 (17%)	2 (33%)	3 (50%)
	Excellent	4	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)
HBB		15						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	9	6 (67%)	6 (67%)	6 (67%)	4 (44%)	4 (44%)	3 (33%)
	Excellent	4	3 (75%)	2 (50%)	3 (75%)	2 (50%)	2 (50%)	3 (75%)

Table 3. Proficiency level identification for training program categories (Number of scenarios and resulting percentage correctly identified in proficiency category)

OSCE	Proficiency Level	n	Rater 1	Rater 2	Rater 3	Rater 4	Rater5	Rater 6
All		42						
	Poor	10	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)	9 (90%)
	Average	32	18 (56%)	16 (50%)	19 (59%)	14 (44%)	19 (59%)	18 (56%)
BAB		15						
	Poor	6	6 (100%)	6 (100%)	6 (100%)	6 (100%)	6 (100%)	5 (83%)
	Average	9	5 (55%)	1 (11%)	3 (33%)	2 (22%)	7 (78%)	5 (66%)
ECEB		12						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	10	4 (40%)	7 (70%)	7 (70%)	5 (50%)	6 (60%)	3 (50%)
HBB		15						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	13	9 (69%)	8 (62%)	9 (69%)	6 (46%)	6 (46%)	6 (46%)

Raters were more accurate in identifying 'poor' and 'excellent' compared to average. Raters identified average proficiency 50% of the time (Table 2 and 3). Information detailing challenges from field notes are presented in Table 4. These include differing perceptions in expected standard of practice, rater fatigue, and multi-step items.

Table 4. Rater Challenges from Field Notes

Challenge	HBB	ECEB	BAB
Differing perceptions of practice standard		How to stimulate baby with back rubs Sequence used to dry the baby	How to massage uterus to stop bleeding How to check for bleeding Item 14: Checks mother for bleeding for 2 hours: changed to checks mother for bleeding every 15 minutes for 2 hours
Tracking multi-step OSCE items	Item 1. Prepares area for delivery Added boxes for: towels, suction, ventilation bag and oxytocin	Item 7: Improves thermal care; Added tracking boxes for removes wet clothing, adds layer of clothing/hat, positions skin to skin, raises room temperature	Item 7: Applies counter pressure when performing controlled cord traction with a contraction: added tracking box for position of hands and one for action occurring with a contraction

	Item 2. Test equipment function; added tracking box for bag/mask and suction Item3. Washes hands Added tracking box for HCP hands, mothers hands and others abdomen Item 5. Removes wet clothes; added tracking box for covers with clean cloth Item 24; communicates with Mother; Added tracking box for putting baby skin to skin, teaching mom to check breathing and breastfeeding	Item 8: Recognizes baby has a danger sign and classifies baby as needing advance care- added tracking box for states baby has danger sign and box for classifies as needing advanced care Item 10. Calculates correct dose of Ampicillin and Gentamicin; Added box for ampicillin and box for gentamycin	Item 12: looks/asks about amount of bleeding; Added Must do one of these: added tracking box to track looks at output in the pail, box looks at vaginal flow; box for asks mother about flow
OSCE English Words		Hypothermia- did not interpret candidate saying mother was cold as co hypothermia	Hypertension- did not interpret candidate saying mother had high blood pressure as hypertension
Actions without verbalizing		Candidate took actions to make the baby warmer but rater marks incomplete for recognizes hypothermia	

DISCUSSION

This is the first the study to describe an OSCE rater training curriculum and present evaluation of the curriculum showing levels of rater agreement for HBB, ECEB and BAB training courses in an LMIC. Quality rater training and subsequent reliability analysis is especially important in LMIC context because of the limited quality assurance monitoring patient safety in the system and

resources.[29-31] Our results suggest that the moderate levels of rater agreement, coupled by notable challenges in discriminating 'acceptable' versus 'poor' performance, exposes a potential for either overestimating or underestimating competence. Additionally, raters were challenged in discriminating 'excellent' versus 'average' performance. This has consequences for the individual, the training program, and the system. If country resources are directed to those who do not need it (overestimated) or miss those who do need it (underestimated), practising clinicians operate with less skilled health providers because some are away at training. Underestimation means that the process may have missed identifying healthcare providers who are providing unsafe care to mothers and babies. Poor competence impedes quality care.[27-29] The system uses participant scores to make decisions about training priorities, continued employment and allocation of resources, which are limited.[26,29-31] This creates further strain in an already vulnerable system.[26,29-31] The programs may need to implement a further strategy such a global health rating scale, which is common practice in the developed world,[17-19,22-25] to help define the borderline healthcare providers who need more training, and healthcare providers who have demonstrated excellent proficiency with training content to be future raters.[27,28] The challenge incurred in discriminating between borderline performance is not isolated to an LMIC context but reported universally.[32-34]

The best practices for OSCE rater training curriculum that we identified through this study reflect similar recommendations from HIC rater training experience. Globally, good practice is for OSCE raters to have relevant content expertise, be well orientated to the OSCE checklist and use a validated rating scale.[22-25] A quality rater training curriculum includes standardized mock scenarios where raters practise with a variety of expected learner proficiency levels demonstrated and practice scored. In a study by Reid and colleagues,[34] the sole use of a satisfactory proficiency

level mock for practice limited generalizability of findings to other proficiency levels. A solid rater curriculum incorporates a framework such as Zabar's (Figure 2) to guide new rater feedback; this is especially important in a setting where the concept of rater training is novel. In our study, Zabar's framework was simple and easy to use as evidenced by a decreased level of external coaching each day.

A study strength was the achievement of a level of rater agreement similar to the few published training course reports for ECEB and HBB. In our participant group, the 'moderate to good' kappa for the ECEB OSCE was as reported by Kassick and colleagues in Ghana, the only other ECEB reported study to include in-country evaluators; a regional and national evaluator.[10] In the HBB OSCE, our findings demonstrated 'fair to moderate' kappa value which was similar to the 'fair to good' kappa value reported by Reisman and colleagues in Tanzania[15] whose raters included two external evaluators and one country based evaluator. Comparable studies for kappa value results for raters scoring the BAB OSCE module are not reported.

In training raters, certain challenges were noted. There was unanticipated variance in rater perceptions of the expected practice standard. Raters were recruited by clinician researchers based on recollections of which previous participants from recent HBB, ECEB, and BAB trainings had performed well; no objective strategy had been employed in their selection. This may contribute to the unanticipated variance in new rater proficiency.

Rater trainees were challenged by OSCE items where scores incorporated multi-steps for their achievement; this was consistent with experiences described by Seto and colleagues who also identified lower rater agreement for HBB OSCE multi-step items.[16] For example, in our study, one HBB OSCE 'item' requires the learner to 'prepare the area for delivery'. To achieve a point and 'pass' this item, the learner must complete all four of: (1) place towels at bedside; (2) place

suction at bedside; (3) place a bag and mask at bedside; and (4) place oxytocin at bedside. This 'item' created confusion amongst rater trainees; during mock session review, several participants had 'passed' the mock scenario learner on this item despite not having seen all steps yet having observed at least one step. To address this gap, we added sub-item tracking boxes; the use of this strategy warrants further study.

Our study was limited by lack of formal training and experience in role-playing by simulated patients. Our 'actors' were not professionally trained (but rather clinicians!) and scenarios and levels were de novo; ideally, with more resources and time, mock scenarios would be formally scripted and/or video-captured to optimize standardization. Additionally, time constraints necessitated working three long days; rater fatigue was likely. This was especially true for one pregnant rater-trainee who participated for the first two days then arrived with newborn in hand on Day 3.

CONCLUSION

Our study shows in rural, Tanzania, training of in-country raters is feasible and effective. This is the first study of its kind in Africa. We hope our experience encourages program developers nationally and internationally to scale up in-country rater training. For LMIC simulation-based training programs to be sustainable, all countries and regions should have their own trained OSCE raters.

Rater training is critical for administering OSCE based learner assessments to maximize reliability and validity of learner outcomes. Global training programs, including HBB, ECEB and the BAB need to be confident that OSCE scores truly reflect learner ability, to identify and support those needing further skill practice. Significant global investments have been made towards

maternal newborn health provider training; participants need to leave workshop venues equipped with the skills to save mother and newborn lives.

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What is already known:

1. Few HBB, ECEB and BAB study results that report improvements post training in healthcare provider skill report rater agreement
2. There is a gap in our knowledge about the relationship between rater training, rater agreement and participant performance
3. There is a gap in our knowledge the appropriate rater training curriculum for in country raters in LMICs

What this study adds:

1. A conceptual framework for training in country health providers as raters in an LMIC
2. It is possible to achieve moderate rater agreement within country healthcare providers as Raters in an LMIC
3. OSCE checklist multi-step items add complexity and should be adapted to a local context

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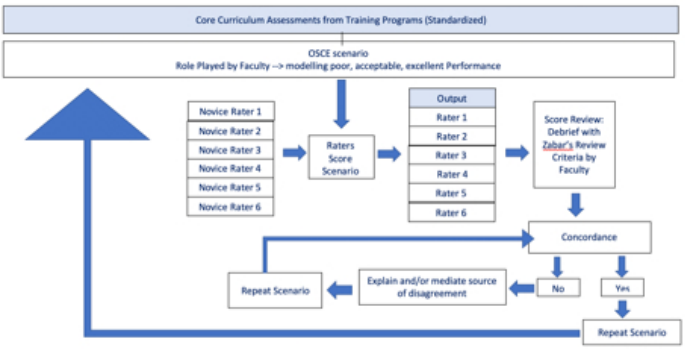

Figure 1. This figure provides a visual of the research design we used in this study. All six raters scored each of the 42 role played scenarios depicting poor, average and excellent levels of performance.

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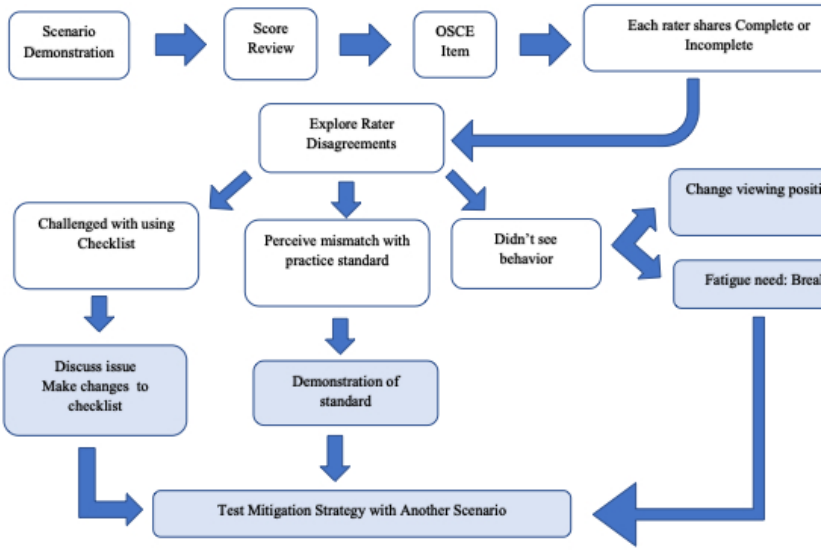

Figure 2. This figure summarizes the conceptual framework we used for score review and feedback. Zabar's review criteria provides guidance in score review with identification of source of rater agreement and mitigation strategy. This framework reflects the experiential learning cycle staring with experience, an opportunity to reflect (item review), abstract conceptualization (use feedback to rethink experience) and direct experimentation (another opportunity) to apply learning.

215x279mm (72 x 72 DPI)

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Rater training for standardized assessment of Objective Structured Clinical Exams in rural Tanzania

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Rater training for standardized assessment of Objective Structured Clinical Exams in rural Tanzania

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Girles Shabani contributed substantially to acquisition and analysis of data, revision of manuscript drafts, approve submitted version and agree to be accountable for all aspects of the work ensuring questions related to accuracy or integrity are examined and resolved.

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Abstract:

OBJECTIVES

To describe a simulation-based rater training curriculum for Objective Structured Clinical Exams (OSCEs) for clinician-based training for front line staff caring for mothers and babies in rural Tanzania.

BACKGROUND

Rater training for OSCE evaluation is widely embraced in high income countries (HIC) but not well described in low and middle-income countries (LMICs). Helping Babies Breathe (HBB), Essential Care for Every Baby (ECEB) and Bleeding after Birth (BAB) are standardized training programs that encourage OSCEs evaluations. Studies examining the reliability of assessments are rare.

METHODS

Training of raters occurred over three days. Raters scored selected OSCEs role played using standardized learners and low fidelity mannikins, assigning proficiency levels *a priori*. Researchers used Zabar's criteria to critique rater agreement and mitigate measurement error during score review. Descriptive statistics, Fleiss' kappa and field notes were used to describe results.

RESULTS

Six healthcare providers scored 42 training scenarios. There was moderate rater agreement across all OSCEs (κ=0.508). Kappa values increased with HBB (κ=0.28 to 0.48), and ECEB (κ=0.42 to 0.77) by Day 3 of training but not with BAB (κ=0.58 to 0.33). Raters identified average proficiency 50% of the time.

CONCLUSION

Our study shows training of in-country raters resulted in the discernment of acceptable proficiency 50% of the time, despite moderate rater agreement. Rater training is critical to ensure that the potential of training programs translates to improved outcomes for mothers and babies; more research into the concepts and training for discernment of competence in this setting is necessary.

BACKGROUND

Helping Babies Breathe (HBB) and Essential Care for Every Baby (ECEB), from the Helping Babies Survive Program[1,2] and the Bleeding after Birth (BAB) from the Helping Mothers Survive (HMS) program[3,4] are examples of standardized health provider training programs designed by expert clinicians and educators from high income countries (HIC) with input from low and middle income countries (LMICs) for use in LMICs. The HBB training course reviews skills related to newborn resuscitation; ECEB focuses on newborn routine care and danger sign identification; BAB reviews management of maternal hemorrhage. All three courses and others in the HMS, HBS series, use low-fidelity mannequins, hands-on simulation practice of common case scenarios and emphasize compliance with algorithm-based 'Action Plans'. Course content addresses common gaps that lead to some of the highest sources of global maternal[5,6] and newborn mortality.[1,2]

The competence of participants in these courses are frequently assessed using Objective Structured Clinical Exams (OSCEs). A number of studies in a variety of LMIC settings have demonstrated improvements in provider competency managing relevant obstetric and neonatal cases post training.[6-16] However, few of these studies provide details of assessor training, or the reliability of the OSCE assessments.[10,15,16] Furthermore, only one study used in-country OSCE raters;[15] others have relied on external (from outside the country of study) development and academic partners serving in rater roles.[9,16] Training of raters to serve as OSCEs assessors is widely embraced in HIC,[17-25] but rater training has not been well described in LMICs. Reisman and colleagues refer to standardized OSCE training but do not report details.[15] Formal pre-OSCE training for assessors aims to minimise sources of measurement error,[17-25] increasing confidence that a participant's OSCE score truly reflects their competence. With OSCE

administration, sources of error can arise from the OSCE structure and/or rater objectivity.[17,19,22,25] Facilitator materials for HBB, ECEB and BAB courses provide clear guidelines to minimise measurement error with the OSCE administration. For example, Jhpeigo provides information on quality assessment[3] for their HMS training series, but there are no guidelines for training OSCE raters or evaluating rater agreement. The purpose of our study was to describe a simulation based OSCE rater training curriculum and assessment of subsequent levels of rater agreement with administration of OSCEs in rural Tanzania using locally trained healthcare providers as raters.

METHOD

This study was embedded within a Simulation Enhanced Maternal Newborn Health training workshop, conducted as part of an ongoing rural education program. The study was approved by Catholic University of Health and Allied Sciences Ethics Board (#CREC/070/2015), the Tanzania National Institute for Medical Research (NIMR) (#MR/53/100/525), and University of Calgary Science and Ethics Board (#REB15-1919).

Patient and Public Involvement

Patients were not involved in this study.

Setting

The study was conducted in Kwimba District located in Mwanza Region, Tanzania over three days; two days in April 2018 and one day in May 2018.

Participants

Raters were recruited from clinical staff practising in the rural health facilities in the district where training was to occur. Selection was based on their demonstrated proficiency in previous Newborn Maternal training workshops conducted in the previous year. All trainees were clinically active in

their health facility settings. All selected participants provided informed consent to be involved in the study. Rater characteristics and Rater OSCE scores for each OSCE scenario were collated under a master tracking number to ensure rater anonymity. Following three days of rater training, participants were involved as raters for OSCE evaluations to assess workshop learners pre and post training, at 6 and at 12 months. The rater training curriculum was led by a team comprised of clinician researchers from Catholic University of Health and Allied Sciences (CUHAS) and University of Calgary.

Design

This study used a descriptive study design (Figure 1). Raters attended rater training prior to any formal scoring of workshop participants. Categorical levels of proficiency (poor, acceptable and excellent) (decided a priori) were role modelled by clinician research team members for each OSCE each day to create a mock scoring context. All six raters observed and scored the exact same scenario at the same time, making judgements about observed behaviors independent of discussion with each other. Scores were collected and then reviewed with the raters; areas of disagreement were explored, using an inquiry approach and direct feedback in debriefing. Zabar's review criteria and mitigation strategies was used as the framework for both the reviews and refining methodology. Categorical levels of proficiency that challenged rater agreement were repeated. Checklists were collected and collated on an MS Excel spreadsheet on a research dedicated computer. Field notes were used to track challenges. SPSS version 26 was used to analyse rater data. Descriptive statistics were used to provide information about mock scoring and rater's abilities to identify the three categorical levels of proficiency. All raw scores indicating excellent levels of proficiency (Table 2) were also analyzed as acceptable (Table 3) to align with training program guidelines; two categories of proficiency. Fleiss' Kappa with

standard error was calculated to provide information about the level of rater agreement.[26] Kappa values of <0.20, 0.21-0.40, 0.41-0.60 and 0.61-0.80 and 0.81to 1.00 are considered poor, fair, moderate, good, and very good respectively.[26]

Evaluation Tools

The OSCEs used were drawn from training program materials.[1-4] There were 24 pass/fail items on the HBB OSCE, 15 items on the ECEB OSCE and 14 items on the BAB OSCE. All raters were familiar with the OSCE checklists and relevant training course content as they had recently participated in the same courses themselves as learners. Poor proficiency, often referred to as 'red' in reported studies was identified by a score of <71%; 0-17, 0-10, and 0-9 on the HBB, ECEB and BAB OSCE, respectively. Learner scores >70% identified an 'acceptable' level of proficiency or 'green' in reported studies; >17, >10, & >9 on HBB, ECEB and BAB respectively.[1-4] The Research team added a third category, a candidate's score of >22, >13 and >12 identified excellent proficiency for HBB, ECEB and BAB OSCEs, respectively. To standardize the proficiency levelin a scenario, a priori the researchers used the clinical consequences of an action to inform the scoring, which was then used to plan the actions role played in the scenario.

The Rater Curriculum

The conceptual framework (Figure 2) and Zabar's review criteria[27] provides details about elements of the curriculum and the iterative nature of the training process. Three physical OSCE stations were set up to facilitate learner transition between each testing station. Checklists were reviewed prior to scoring practice Day 1 of training to ensure raters were familiar with OSCE items and how to use the checklist in scoring. Raters observed a scenario, with a predetermined level of proficiency. Training of raters occurred in the score review, with faculty leading discussions to discern the underlying ideas or concepts which may have led to the disagreement.

Raters learned about potential sources of error in the discussion of rater disagreements in score review. Faculty discussed the importance of mitigating these sources of error to improve score reliability. Scenarios with disagreement on two or more items were repeated.

RESULTS

Raters (*n*=6) included physicians (*n*=1), midwives (n=4) and nurses (*n*=1). All study participants completed the three full days of rater training which included participation in scoring and a focused debrief for 42 scenarios over the three days. Table one provides details about scenario scoring for HBB, ECEB and AMSTL over the three days.

Table 1. Kappa values

Training Program	Proficiency Level	n	Average		n	Day 1 (n=16)		n	Day 2 (n=14)		n	Day 3 (n=12)	
			Fleiss' K	Standard error		Fleiss' K	Standard error		Fleiss' K	Standard error		Fleiss' K	Standard error
HBB		15	0.43	0.07		0.28	0.12		0.58	0.12		0.48	0.12
	Poor	2			0			1			1		
	Acceptable	13			5			4			4		
ECEB		12	0.61	0.07		0.42	0.10		0.70	0.13		0.77	0.15
	Poor	2			1			1			0		
	Acceptable	10			4			3			3		
BAB		15	0.46	0.07		0.58	0.12		0.19	0.12		0.33	0.12
	Poor	6			2			2			2		
	Acceptable	9			3			3			3		
All OSCEs			0.508	0.04									

The time needed for each OSCE station with score review was longer for average proficiency levels (30-40 minutes) when compared to 'excellent' and 'poor' proficiency levels (15-20 minutes). Fleiss' Kappa values (Table 1) showed that there was a moderate level of rater agreement in identifying 'poor' and 'acceptable' proficiency across all OSCEs (κ=0.51). Kappa values improved over the three days moving from 'fair' to 'moderate' for the HBB OSCE and

193 'moderate' to 'good' for the ECEB OSCE. The kappa value for BAB was 'moderate' Day 1 but
194 decreased to 'fair' Day 2 and Day 3. Information about rater abilities to correctly identify
195 proficiency levels is described in Table 2 and 3.

196

Table 2. Proficiency level identification (Number of scenarios and resulting percentage correctly identified in proficiency category)

OSCE	Proficiency Level	n	Rater 1	Rater 2	Rater 3	Rater 4	Rater5	Rater 6
All		42						
	Poor	10	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)	9 (90%)
	Average	18	8 (44%)	9 (50%)	9 (50%)	5 (28%)	8 (44%)	8 (44%)
	Excellent	14	10 (71%)	7 (50%)	10 (71%)	8 (57%)	11 (79%)	10 (71%)
BAB		15						
	Poor	6	6 (100%)	6 (100%)	6 (100%)	6 (100%)	6 (100%)	5 (83%)
	Average	3	2 (66%)	0 (0%)	0 (0%)	0 (0%)	2 (66%)	2 (66%)
	Excellent	6	3(50%)	1 (17%)	3 (50%)	2 (33%)	5 (83%)	3 (50%)
ECEB		12						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	6	0 (0%)	3 (50%)	3 (50%)	1 (17%)	2 (33%)	3 (50%)
	Excellent	4	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)
HBB		15						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	9	6 (67%)	6 (67%)	6 (67%)	4 (44%)	4 (44%)	3 (33%)
	Excellent	4	3 (75%)	2 (50%)	3 (75%)	2 (50%)	2 (50%)	3 (75%)

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Table 3. Proficiency level identification: (average and excellent categories combined) for training program categories (Number of scenarios and resulting percentage correctly identified in proficiency category)

OSCE	Proficiency Level	n	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
All		42						
	Poor	10	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)	9 (90%)
	Average	32	18 (56%)	16 (50%)	19 (59%)	14 (44%)	19 (59%)	18 (56%)
BAB		15						
	Poor	6	6 (100%)	6 (100%)	6 (100%)	6 (100%)	6 (100%)	5 (83%)
	Average	9	5 (55%)	1 (11%)	3 (33%)	2 (22%)	7 (78%)	5 (66%)
ECEB		12						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	10	4 (40%)	7 (70%)	7 (70%)	5 (50%)	6 (60%)	3 (50%)
HBB		15						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	13	9 (69%)	8 (62%)	9 (69%)	6 (46%)	6 (46%)	6 (46%)

Raters were more accurate in identifying 'poor' and 'excellent' compared to average. Raters identified average proficiency approximately 50% of the time (Table 2 and 3). Information detailing challenges from field notes are presented in Table 4.

Table 4. Rater Challenges from Field Notes

Challenge	HBB	ECEB	BAB
Differing perceptions of practice standard		Back rub stimulation Sequence for drying baby	Fundal Massage Bleeding Assessment Frequency of bleeding assessment
Tracking multi-step OSCE items	Item 1. Prepares area for delivery Item 2. Equipment preparation Item3. Hand washing Item 5. Removes wet clothes Item 24. Communication and teaching	Item 7: Improves thermal care Item 8: Identifying danger signs Advanced care classification Item 10. Medication calculation and administration	Item 7. Controlled cord traction counter pressure Item 12. Determining Postpartum hemorrhage
OSCE English Words		Hypothermia	Hypertension
Actions without verbalizing		Warming baby	

DISCUSSION

This study describes an OSCE rater training curriculum and presents evaluation of the curriculum showing levels of rater agreement for HBB, ECEB and BAB training courses in an LMIC. Quality rater training and subsequent reliability analysis is especially important in LMIC context because of the limited quality assurance monitoring patient safety in the system and resources.[28-31] Our results suggest that the moderate levels of rater agreement, coupled by notable challenges in discriminating 'acceptable' performance, exposes a potential for either

overestimating or underestimating competence. This has consequences for the individual, the training program, and the system. The challenge incurred in discriminating between borderline performance is not isolated to an LMIC context but reported universally.[32-34] With overestimation of competence, training programs may have passed clinicians who may need more training to provide safe care on the frontline. The problem of accurate discrimination of competency affects resource utilization: with underestimation of competence, training programs may be directing the limited resources to clinicians who do not need extra training. Furthermore, frontline staff frequently work short staffed when someone is away at training, so unnecessary remediation training may exacerbate staff overload.[28-31]

In the majority of HBB, ECEB and BAB training program reports, validation of improved care-giver competency is determined by comparing pre and post training OSCE scores. Our results suggest that the existing reports describing a moderate IRR may be misleading without further validation of the accuracy of rater discernment of acceptable proficiency. [10,15,16] Our raters achieved moderate rater agreement yet discernment of acceptable proficiency, which is the pass criterion in these training programs, was approximately 50%. Based on our findings we would suggest including both measures of validation) Considering contexts with limited resources, it may be helpful to implement a further strategy such a global rating scale, which is common practice in the developed world[17-19,22-25] to provide another method of validation of participant competence.[35] A global rating scale allows the rater to evaluate how well a learner performs on a scale of 1 to 5, with 5 reflecting the highest level of competence.[35] More than one method of validation creates more certainty that results are an accurate reflection of participant competence and/or training program efficacy.[35] With the continued high reports of maternal and neonatal mortality, it is important to be confident that

these training programs are accurate in identifying and supporting clinicians who may not be providing safe care on the frontline. Based on our findings we would suggest including both measures of validation.

The guidelines for OSCE rater training used in this study were based on recommendations from HIC rater training experiences; these are challenging to implement in an LMIC context. Globally, good practice is for OSCE raters to have relevant content expertise, be well orientated to the OSCE checklist and use a validated rating scale.[22-26] Although we strived for this, we had a limited pool of potential raters; this may have affected the challenges we noted in rater perceptions of the expected practice standard. Raters were recruited by clinician researchers based on recollections of which previous participants from recent HBB, ECEB, and BAB trainings had performed well; no objective strategy was employed in their selection. This was the reason in country faculty inserted a third categorical level of proficiency; excellent. They wanted an objective strategy to identify content experts as the future raters for such training programs. A quality rater training curriculum includes standardized mock scenarios where raters practise and score a variety of expected learner proficiency levels. In our study, this was one of the greatest challenges. Research clinicians role playing scenarios Day 1 were challenged in demonstrating poor proficiency. In discussion, they shared they didn't want participants to think they were not experts in the field. The inclusion of scripted and video capture of proficiency levels may lessen this tension and inconsistency in role play. In a limited resource setting this is challenging to develop and implement. Despite this, the level of rater agreement improved over the three training days for both HBB and ECEB. The fall-off in rater agreement for BAB Day 2 and 3 was unexpected but may be in part related to the timing of these scenarios; they were the last role plays of the day and rater fatigue may have played a role.

A solid rater curriculum incorporates a framework such as Zabar's (Figure 2) to guide rater feedback; this is especially important in a setting where the concept of rater training is novel.[27] In our study, Zabar's framework was simple and easy to use as evidenced by a decreased level of external coaching each day.

A study strength was the achievement of a level of rater agreement similar to the few published training course reports for ECEB and HBB. In our participant group, the 'moderate to good' kappa for the ECEB OSCE was as reported by Kassick and colleagues in Ghana, the only other ECEB reported study to include in-country evaluators; a regional and national evaluator.[10] In the HBB OSCE, our findings demonstrated 'fair to moderate' kappa value which was similar to the 'fair to good' kappa value reported by Reisman and colleagues in Tanzania[15] whose raters included two external evaluators and one country based evaluator. Comparable studies for kappa value results for raters scoring the BAB OSCE module are not reported. The achievement of comparable IRR to the studies using in country and external partners provides support for the rater training curriculum, yet the inability to accurately discern acceptable proficiency (pass criteria) is concerning. To gain further insight into the relationship between faculty role play and the inability to discern acceptable proficiency, we plan to script the acceptable proficiency level for each OSCE, coach faculty in the role play, and repeat the curriculum and analysis.

Rater trainees were challenged by OSCE items where scores incorporated multi-steps for their achievement; this was consistent with experiences described by Seto and colleagues who also identified lower rater agreement for HBB OSCE multi-step items.[16] For example, in our study, one HBB OSCE 'item' requires the learner to 'prepare the area for delivery'. To achieve a point and 'pass' this item, the learner must complete all four of: (1) place towels at bedside; (2) place

suction at bedside; (3) place a bag and mask at bedside; and (4) place oxytocin at bedside. This 'item' created confusion amongst rater trainees; during mock session review, several participants had 'passed' the mock scenario learner on this item despite not having seen all steps yet having observed at least one step. To address this gap, we added sub-item tracking boxes when this challenge was identified Day 1; the use of this strategy warrants further study.

Our study was limited by lack of formal training and experience in role-playing by simulated learners. Our 'actors' were not professionally trained (but rather research clinicians!) and scenarios and levels were de novo; ideally, with more resources and time, mock scenarios would be formally scripted and/or video-captured to optimize standardization. Additionally, time constraints necessitated working three long days; rater fatigue was likely. This was especially true for one pregnant rater-trainee who participated for the first two days then arrived with newborn in hand on Day 3. Our results may have limitations in generalisability but do provide context and learning for others interested in developing a rater training curriculum in a low resource setting.

CONCLUSION

Our results show that rater training in an LMIC setting is critical for administering OSCE based learner assessments. Clinician everywhere need ongoing training, but to optimize learning and then translate this to improved outcomes for mothers and babies, this training must be informed by truly objective evaluations. Our study shows in rural, Tanzania, training of in-country raters is possible and can lead to an IRR which is similar to previous studies. Improved standardization and attention to the relationships between IRR and the accurate discernment of participant performance would provide insight into needed modifications, which in turn may lead to greater accuracy in rating competence. More research is warranted. Global training programs, including

HBB, ECEB and the BAB need to be confident that OSCE scores truly reflect learner ability, to identify and support those needing further skill practice. Significant global investments have been made towards maternal newborn health provider training; participants need to leave workshop venues equipped with the skills to save mother and newborn lives. We hope this experience encourages program developers nationally and internationally to scale up in-country rater training. For LMIC simulation-based training programs to be sustainable, all countries and regions should have their own trained OSCE raters.

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What is already known:

1. Few HBB, ECEB and BAB study results that report improvements post training in healthcare provider skill report rater agreement
2. There is a gap in our knowledge about the relationship between rater training, rater agreement and participant performance
3. There is a gap in our knowledge the appropriate rater training curriculum for in country raters in LMICs

What this study adds:

1. A conceptual framework for training in country health providers as raters in an LMIC
2. It is possible to achieve moderate rater agreement within country healthcare providers as Raters in an LMIC
3. OSCE checklist multi-step items add complexity and should be adapted to a local context

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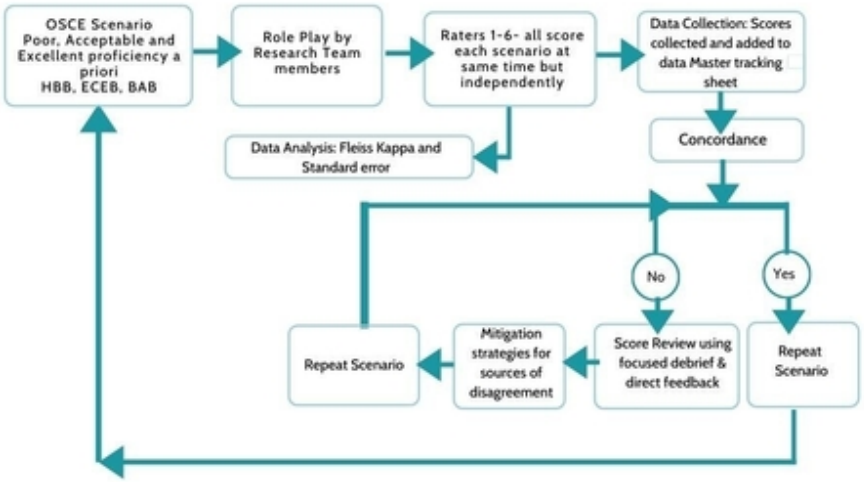

Figure 1. This figure provides a visual of the research design we used in the study each day. All six raters scored all 42 of the role played scenarios with proficiency determined a priori. Raters participated in 42 debrief sessions over the three days.

43x32mm (300 x 300 DPI)

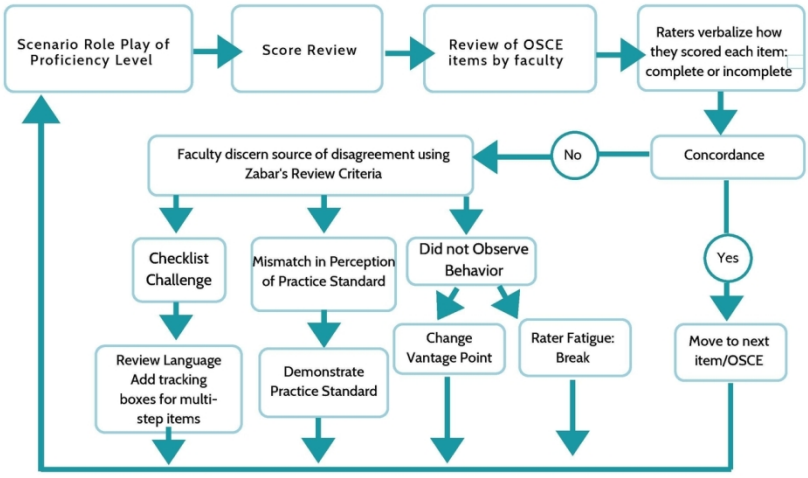

Figure 2. This figure provides a visual of the Conceptual framework used to improve the level of rater agreement.

135x101mm (300 x 300 DPI)

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Rater training for standardized assessment of Objective Structured Clinical Exams in rural Tanzania

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Key Words Simulation Training, Community Child Health, Resuscitation, Mortality, Medical Education

Word Count: 2928

Abstract:

OBJECTIVES

To describe a simulation based rater training curriculum for Objective Structured Clinical Exams (OSCEs) for clinician based training for front line staff caring for mothers and babies in rural Tanzania.

BACKGROUND

Rater training for OSCE evaluation is widely embraced in high income countries but not well described in low and middle-income countries. Helping Babies Breathe, Essential Care for Every Baby and Bleeding after Birth are standardized training programs that encourage OSCEs evaluations. Studies examining the reliability of assessments are rare.

METHODS

Training of raters occurred over three days. Raters scored selected OSCEs role played using standardized learners and low fidelity mannikins, assigning proficiency levels *a priori*. Researchers used Zabar's criteria to critique rater agreement and mitigate measurement error during score review. Descriptive statistics, Fleiss' kappa and field notes were used to describe results.

RESULTS

Six healthcare providers scored 42 training scenarios. There was moderate rater agreement across all OSCEs (κ=0.508). Kappa values increased with Helping Babies Breathe (κ=0.28 to 0.48), and Essential Care for Every Baby (κ=0.42 to 0.77) by Day 3 of training but not with Bleeding after Birth (κ=0.58 to 0.33). Raters identified average proficiency 50% of the time.

CONCLUSION

Our study shows that the in-country raters in this study had a hard time identifying average performance despite moderate rater agreement. Rater training is critical to ensure that the potential of training programs translates to improved outcomes for mothers and babies; more research into the concepts and training for discernment of competence in this setting is necessary.

BACKGROUND

Helping Babies Breathe (HBB) and Essential Care for Every Baby (ECEB), from the Helping Babies Survive Program[1,2] and the Bleeding after Birth (BAB) from the Helping Mothers Survive (HMS) program[3,4] are examples of standardized health provider training programs designed by expert clinicians and educators from high income countries (HIC) with input from low and middle income countries (LMICs) for use in LMICs. The HBB training course reviews skills related to newborn resuscitation; ECEB focuses on newborn routine care and danger sign identification; BAB reviews management of maternal hemorrhage. All three courses and others in the HMS, HBS series, use low-fidelity mannequins, hands-on simulation practice of common case scenarios and emphasize compliance with algorithm-based 'Action Plans'. Course content addresses common gaps that lead to some of the highest sources of global maternal[5,6] and newborn mortality. [1,2]

The competence of participants in these courses are frequently assessed using Objective Structured Clinical Exams (OSCEs). A number of studies in a variety of LMIC settings have demonstrated improvements in provider competency managing relevant obstetric and neonatal cases post training.[6-16] However, few of these studies provide details of assessor training, or the reliability of the OSCE assessments. [10,15,16] Furthermore, only one study used in-country OSCE raters;[15] others have relied on external (from outside the country of study) development and academic partners serving in rater roles.[9,16] Training of raters to serve as OSCEs assessors is widely embraced in HIC,[17-25] but rater training has not been well described in LMICs. Reisman and colleagues refer to standardized OSCE training but do not report details.[15] Formal pre-OSCE training for assessors aims to minimise sources of measurement error, [17-25] increasing confidence that a participant's OSCE score truly reflects their competence. With OSCE

administration, sources of error can arise from the OSCE structure and/or rater objectivity.[17,19,22,25] Facilitator materials for HBB, ECEB and BAB courses provide clear guidelines to minimise measurement error with the OSCE administration. For example, Jhpeigo provides information on quality assessment[3] for their HMS training series, but there are no guidelines for training OSCE raters or evaluating rater agreement. The purpose of our study was to describe a simulation-based OSCE rater training curriculum and assessment of subsequent levels of rater agreement with administration of OSCEs in rural Tanzania using locally trained healthcare providers as raters.

METHOD

This study was embedded within a Simulation Enhanced Maternal Newborn Health training workshop, conducted as part of an ongoing rural education program. The study was approved by Catholic University of Health and Allied Sciences Ethics Board (#CREC/070/2015), the Tanzania National Institute for Medical Research (NIMR) (#MR/53/100/525), and University of Calgary Science and Ethics Board (#REB15-1919).

Patient and Public Involvement

Patients were not involved in this study.

Setting

The study was conducted in Kwimba District located in Mwanza Region, Tanzania over three days; two days in April 2018 and one day in May 2018.

Participants

Raters were recruited from clinical staff practising in the rural health facilities in the district where training was to occur. Selection was based on their demonstrated proficiency in previous Newborn Maternal training workshops conducted in the previous year. All trainees were clinically active in

their health facility settings. All selected participants provided informed consent to be involved in the study. Rater characteristics and Rater OSCE scores for each OSCE scenario were collated under a master tracking number to ensure rater anonymity. Following three days of rater training, participants were involved as raters for OSCE evaluations to assess workshop learners pre and post training, at 6 and at 12 months. The rater training curriculum was led by a team comprised of clinician researchers from Catholic University of Health and Allied Sciences (CUHAS) and University of Calgary.

Design

This study used a descriptive study design (Figure 1). Raters attended rater training prior to any formal scoring of workshop participants. Categorical levels of proficiency (poor, acceptable and excellent) (decided a priori) were role modelled by clinician research team members for each OSCE each day to create a mock scoring context. All six raters observed and scored the exact same scenario at the same time, making judgements about observed behaviors independent of discussion with each other. Scores were collected and then reviewed with the raters; areas of disagreement were explored, using an inquiry approach for debriefing. Zabar's review criteria and mitigation strategies was used as the framework for both the reviews and refining methodology. . The research team lead (content expert) gave direct feedback Categorical levels of proficiency that challenged rater agreement were repeated. Checklists were collected and collated on an MS Excel spreadsheet on a research dedicated computer. Field notes were used to track challenges. SPSS version 26 was used to analyse rater data. Descriptive statistics were used to provide information about mock scoring and rater's abilities to identify the three categorical levels of proficiency. All raw scores indicating excellent levels of proficiency (Table 2) were also analyzed as acceptable (Table 3) to align with training program guidelines; two

categories of proficiency. Fleiss' Kappa with standard error was calculated to provide information about the level of rater agreement.[27] Kappa values of <0.20, 0.21-0.40, 0.41-0.60 and 0.61-0.80 and 0.81to 1.00 are considered poor, fair, moderate, good, and very good respectively.[27]

Evaluation Tools

The OSCEs used were drawn from training program materials. [1-4] There were 24 pass/fail items on the HBB OSCE, 15 items on the ECEB OSCE and 14 items on the BAB OSCE. All raters were familiar with the OSCE checklists and relevant training course content as they had recently participated in the same courses themselves as learners. Poor proficiency, often referred to as 'red' in reported studies was identified by a score of <71%; 0-17, 0-10, and 0-9 on the HBB, ECEB and BAB OSCE, respectively. Learner scores >70% identified an 'acceptable' level of proficiency or 'green' in reported studies; >17, >10, & >9 on HBB, ECEB and BAB respectively.[1-4] The Research team added a third category, a candidate's score of >22, >13 and >12 identified excellent proficiency for HBB, ECEB and BAB OSCEs, respectively. To standardize the proficiency level deemed to be acceptable in a scenario, a priori the researchers used the clinical consequences of an action to inform the scoring, which was then used to plan the actions role played in the scenario.

The Rater Curriculum

The conceptual framework (Figure 2) and Zabar's review criteria[28] provides details about elements of the curriculum and the iterative nature of the training process. Three physical OSCE stations were set up to facilitate learner transition between each testing station. Checklists were reviewed prior to scoring practice Day 1 of training to ensure raters were familiar with OSCE items and how to use the checklist in scoring. Raters observed a scenario, with a predetermined level of proficiency. Training of raters occurred in the score review, with faculty leading

discussions to discern the underlying ideas or concepts which may have led to the disagreement. Raters learned about potential sources of error in the discussion of rater disagreements in score review. Faculty discussed the importance of mitigating these sources of error to improve score reliability. Scenarios with disagreement on two or more items were repeated.

RESULTS

Raters (*n*=6) included physicians (*n*=1), midwives (n=4) and nurses (*n*=1). All study participants completed the three full days of rater training which included participation in scoring and a focused debrief for 42 scenarios over the three days. Table one provides details about scenario scoring for HBB, ECEB and AMSTL over the three days.

Table 1. Kappa values

Training Program	Proficiency Level	n	Average		n	Day 1 (n=16)		n	Day 2 (n=14)		n	Day 3 (n=12)	
			Fleiss' K	Standard error		Fleiss' K	Standard error		Fleiss' K	Standard error		Fleiss' K	Standard error
HBB		15	0.43	0.07		0.28	0.12		0.58	0.12		0.48	0.12
	Poor	2			0			1			1		
	Acceptable	13			5			4			4		
ECEB		12	0.61	0.07		0.42	0.10		0.70	0.13		0.77	0.15
	Poor	2			1			1			0		
	Acceptable	10			4			3			3		
BAB		15	0.46	0.07		0.58	0.12		0.19	0.12		0.33	0.12
	Poor	6			2			2			2		
	Acceptable	9			3			3			3		
All OSCEs			0.508	0.04									

The time needed for each OSCE station with score review was longer for average proficiency levels (30-40 minutes) when compared to 'excellent' and 'poor' proficiency levels (15-20 minutes). Fleiss' Kappa values (Table 1) showed that there was a moderate level of rater agreement in identifying 'poor' and 'acceptable' proficiency across all OSCEs (κ=0.51). Kappa values improved over the three days moving from 'fair' to 'moderate' for the HBB OSCE and

'moderate' to 'good' for the ECEB OSCE. The kappa value for BAB was 'moderate' Day 1 but decreased to 'fair' Day 2 and Day 3. Information about rater abilities to correctly identify proficiency levels is described in Table 2 and 3.

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Table 2. Proficiency level identification (Number of scenarios and resulting percentage correctly identified in proficiency category)

OSCE	Proficiency Level	n	Rater 1	Rater 2	Rater 3	Rater 4	Rater5	Rater 6
All		42						
	Poor	10	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)	9 (90%)
	Average	18	8 (44%)	9 (50%)	9 (50%)	5 (28%)	8 (44%)	8 (44%)
	Excellent	14	10 (71%)	7 (50%)	10 (71%)	8 (57%)	11 (79%)	10 (71%)
BAB		15						
	Poor	6	6 (100%)	6 (100%)	6 (100%)	6 (100%)	6 (100%)	5 (83%)
	Average	3	2 (66%)	0 (0%)	0 (0%)	0 (0%)	2 (66%)	2 (66%)
	Excellent	6	3(50%)	1 (17%)	3 (50%)	2 (33%)	5 (83%)	3 (50%)
ECEB		12						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	6	0 (0%)	3 (50%)	3 (50%)	1 (17%)	2 (33%)	3 (50%)
	Excellent	4	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)
HBB		15						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	9	6 (67%)	6 (67%)	6 (67%)	4 (44%)	4 (44%)	3 (33%)
	Excellent	4	3 (75%)	2 (50%)	3 (75%)	2 (50%)	2 (50%)	3 (75%)

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Table 3. Proficiency level identification: (average and excellent categories combined) for training program categories (Number of scenarios and resulting percentage correctly identified in proficiency category)

OSCE	Proficiency Level	n	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6
All		42						
	Poor	10	10 (100%)	10 (100%)	10 (100%)	10 (100%)	10 (100%)	9 (90%)
	Average	32	18 (56%)	16 (50%)	19 (59%)	14 (44%)	19 (59%)	18 (56%)
BAB		15						
	Poor	6	6 (100%)	6 (100%)	6 (100%)	6 (100%)	6 (100%)	5 (83%)
	Average	9	5 (55%)	1 (11%)	3 (33%)	2 (22%)	7 (78%)	5 (66%)
ECEB		12						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	10	4 (40%)	7 (70%)	7 (70%)	5 (50%)	6 (60%)	3 (50%)
HBB		15						
	Poor	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
	Average	13	9 (69%)	8 (62%)	9 (69%)	6 (46%)	6 (46%)	6 (46%)

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Raters were more accurate in identifying 'poor' and 'excellent' compared to average, and often identified excellent proficiency level scenarios as average. Raters identified average proficiency approximately 50% of the time (Table 2 and 3). Information detailing challenges from field notes are presented in Table 4.

Table 4. Rater Challenges from Field Notes

Challenge	HBB	ECEB	BAB
Differing perceptions of practice standard		Back rub stimulation Sequence for drying baby	Fundal Massage Bleeding Assessment Frequency of bleeding assessment
Tracking multi-step OSCE items	Item 1. Prepares area for delivery Item 2. Equipment preparation Item3. Hand washing Item 5. Removes wet clothes Item 24. Communication and teaching	Item 7: Improves thermal care Item 8: Identifying danger signs Advanced care classification Item 10. Medication calculation and administration	Item 7. Controlled cord traction counter pressure Item 12. Determining Postpartum hemorrhage
OSCE English Words		Hypothermia	Hypertension
Actions without verbalizing		Warming baby	

DISCUSSION

This study describes an OSCE rater training curriculum and presents evaluation of the curriculum showing levels of rater agreement for HBB, ECEB and BAB training courses in an LMIC. Quality rater training and subsequent reliability analysis is especially important in LMIC

context because of the limited quality assurance monitoring patient safety in the system and resources.[29-31] Our results suggest that the moderate levels of rater agreement, coupled by notable challenges in discriminating 'acceptable' performance, exposes a potential for either overestimating or underestimating competence. This has consequences for the individual, the training program, and the system. The challenge incurred in discriminating between borderline performance is not isolated to an LMIC context but reported universally.[32-34] With overestimation of competence, training programs may have passed clinicians who may need more training to provide safe care on the frontline. The problems of accurate discrimination of competency also affect resource utilization: with underestimation of competence, training programs may be directing the limited resources to clinicians who do not need extra training. Further, frontline staff frequently work short staffed when someone is away at training, so that unnecessary remediation training may exacerbate staff overload. .[26,29-31]

In the majority of HBB, ECEB and BAB training program reports, validation of improved care-giver competency is determined by comparing pre and post training OSCE scores. Our results suggest that the existing reports describing a moderate IRR may be misleading without further validation of the accuracy of rater discernment of acceptable proficiency. [10.15.16] Our raters achieved moderate rater agreement yet discernment of acceptable proficiency, which is the pass criterion in these training programs, was approximately 50%. Based on our findings we would suggest including both measures of validation. Considering contexts with limited resources, it may be helpful to implement a further strategy such a global rating scale, which is common practice in HICs [17-19,22-25] to provide another method of validation of participant competence. [27,28] A global rating scale allows the rater to evaluate how well a learner performs on a scale of 1 to 5, with 5 reflecting the highest level of

competence.[28] More than one method of validation creates more certainty that results are an accurate reflection of participant competence and/or training program efficacy [27]. With the continued high reports of maternal and neonatal mortality, it is important to be confident that these training programs are accurate in identifying and supporting clinicians who may not be providing safe care on the frontline.

The guidelines for OSCE rater training used in this study were based on recommendations from HIC rater training experiences; these are challenging to implement in an LMIC context. Globally, good practice is for OSCE raters to have relevant content expertise, be well orientated to the OSCE checklist and use a validated rating scale.[22-25] Although we strived for this, we had a limited pool of potential raters; this may have affected the challenges we noted in rater perceptions of the expected practice standard. Raters were recruited by clinician researchers based on recollections of which previous participants from recent HBB, ECEB, and BAB trainings had performed well; no objective strategy was employed in their selection. This was the reason in country faculty inserted a third categorical level of proficiency; excellent. They wanted an objective strategy to identify content experts as the future raters for such training programs. A quality rater training curriculum includes standardized mock scenarios where raters practise with a variety of expected learner proficiency levels demonstrated and practice scored. In our study, this was one of the greatest challenges. Research Clinicians role playing scenarios Day 1 were challenged in demonstrating poor proficiency. In discussion, they shared they didn't want participants to think they were not experts in the field. The inclusion of scripted and video capture of proficiency levels may lessen this tension and inconsistency in role play. Despite this, the level of rater agreement improved over the three training days for both HBB and ECEB. The fall-off in rater agreement for BAB Day 3 was

unexpected but may be in part related to the timing of these scenarios Day 3; they were the last role plays of the day and rater fatigue may have played a role. Additionally, the greater number of differing perceptions of the practice standard (Table 4) may have impacted this finding.

A solid rater curriculum incorporates a framework such as Zabar's (Figure 2) to guide rater feedback; this is especially important in a setting where the concept of rater training is novel. In our study, Zabar's framework was simple and easy to use as evidenced by a decreased level of external coaching each day.

A study strength was the achievement of a level of rater agreement similar to the few published training course reports for ECEB and HBB. In our participant group, the 'moderate to good' kappa for the ECEB OSCE was as reported by Kassick and colleagues in Ghana, the only other ECEB reported study to include in-country evaluators; a regional and national evaluator.[10] In the HBB OSCE, our findings demonstrated 'fair to moderate' kappa value which was similar to the 'fair to good' kappa value reported by Reisman and colleagues in Tanzania[15] whose raters included two external evaluators and one country based evaluator. Comparable studies for kappa value results for raters scoring the BAB OSCE module are not reported. The achievement of comparable IRR to the studies using in country and external partners provides support for the rater training curriculum, yet the inability to accurately discern acceptable proficiency (pass criteria) is concerning. To gain further insight into the relationship between faculty role play and the inability to discern acceptable proficiency, we plan to script the acceptable proficiency level for each OSCE, coach faculty in the role play, and repeat the curriculum and analysis.

Rater trainees were challenged by OSCE items where scores incorporated multi-steps for their achievement; this was consistent with experiences described by Seto and colleagues who also

identified lower rater agreement for HBB OSCE multi-step items.[16] For example, in our study, one HBB OSCE 'item' requires the learner to 'prepare the area for delivery'. To achieve a point and 'pass' this item, the learner must complete all four of: (1) place towels at bedside; (2) place suction at bedside; (3) place a bag and mask at bedside; and (4) place oxytocin at bedside. This 'item' created confusion amongst rater trainees; during mock session review, several participants had 'passed' the mock scenario learner on this item despite not having seen all steps yet having observed at least one step. To address this gap, we added sub-item tracking boxes when this challenge was identified Day 1; the use of this strategy warrants further study.

Our study was limited by lack of formal training and experience in role-playing by simulated learners. Our 'actors' were not professionally trained (but rather research clinicians!) and scenarios and levels were de novo; ideally, with more resources and time, mock scenarios would be formally scripted and/or video-captured to optimize standardization. Additionally, time constraints necessitated working three long days; rater fatigue was likely. This was especially true for one pregnant rater-trainee who participated for the first two days then arrived with newborn in hand on Day 3. Our results may have limitations in generalisability but do provide some context and learning for others interested in developing a rater training curriculum in a low resource setting.

CONCLUSION

Our results show that rater training in an LMIC setting is critical for administering OSCE based learner assessments especially since the raters in this study had a hard time identifying average performance. Clinician everywhere need ongoing training, but to optimize learning and then translate this to improved outcomes for mothers and babies, this training must be informed by truly

objective evaluations. Our study shows in rural, Tanzania, training of in-country raters is possible and can lead to an IRR which is similar to previous studies. Improved standardization and attention to the relationships between IRR and the accurate discernment of participant performance would provide insight into needed modifications, which in turn may lead to greater accuracy in rating competence. More research is warranted. Global training programs, including HBB, ECEB and the BAB need to be confident that OSCE scores truly reflect learner ability, to identify and support those needing further skill practice. Significant global investments have been made towards maternal newborn health provider training; participants need to leave workshop venues equipped with the skills to save mother and newborn lives. We hope this experience encourages program developers nationally and internationally to scale up in-country rater training. For LMIC simulation-based training programs to be sustainable, all countries and regions should have their own trained OSCE raters.

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What is already known:

1. Studies examining the effectiveness of Helping Babies Breathe, Essential Care for Every Baby and Bleeding after Birth report improvements in clinician skill post training.
2. Global partners support course evaluations in most published studies.
3. Experts in the field recommend that all examiners undergo rater training prior to becoming an OSCE assessor.

What this study adds:

1. A conceptual framework for training in country health providers as raters in an LMIC
2. ***Raters had a hard time identifying average performance, despite the achievement of moderate rater agreement.***
3. Raters often identified excellent proficiency as average.
4. OSCE checklist multi-step items add complexity and should be adapted to a local context

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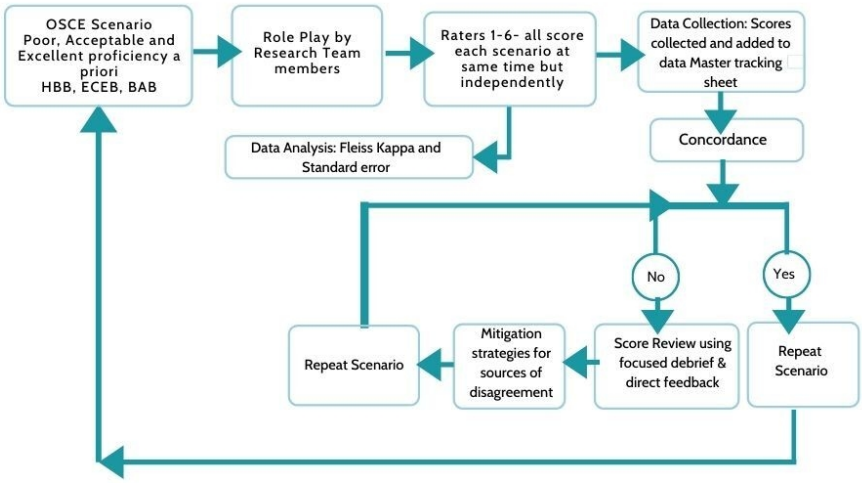

Figure 1. This figure provides a visual of the research design we used in the study each day. All six raters scored all 42 of the role played scenarios with proficiency determined a priori. Raters participated in 42 debrief sessions over the three days.

43x32mm (600 x 600 DPI)

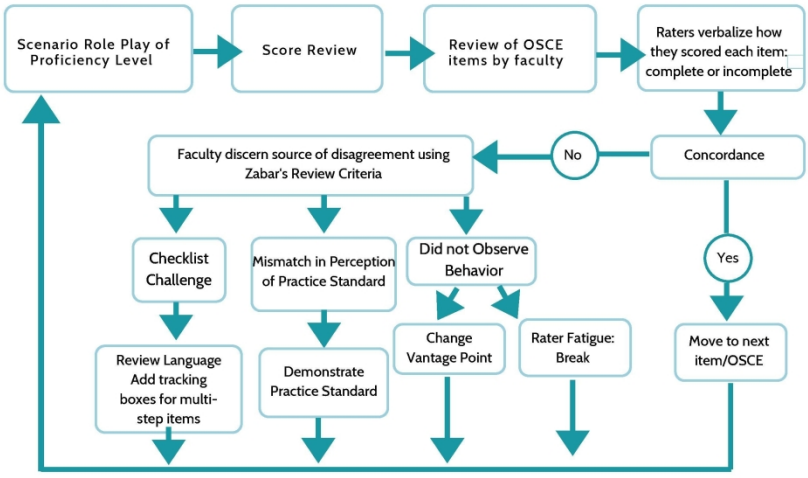

Figure 2. This figure provides a visual of the Conceptual framework used to improve the level of rater agreement.

135x101mm (600 x 600 DPI)