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Improving the quality of obstetric care in Zimbabwe through implementation of a modified obstetric early warning system (MOEWS).

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Abstract

Objective: To implement the Modified Obstetric Early Warning System(MOEWS) to promote identification and stabilization of unwell women.

Methods: This before and after study of MOEWS implementation took place between April 2013 and January 2014, in a Government referral hospital in Zimbabwe. After piloting MOEWS, caesarean section case files were retrospectively assessed to ascertain pre-operative stabilization. A longitudinal 'spot-check' study, measured the use of MOEWS and action taken on abnormal results. A quality indicator was introduced to assess ongoing implementation. Results were analyzed using chi-squared and logistic regression techniques.

Results: The caesarean section study included 78 women before and 80 after MOEWS implementation. There was a significant improvement in pre-operative stabilization post-intervention(OR 2.78 95% CI 1.39, 5.54). The longitudinal study included 43 women at baseline and 85 post-implementation. A significant improvement was recorded in action taken after MOEWS (1/24(4.17%) vs 28/45(60%) p=0.001). The six-month aggregated quality indicator revealed 78/125(62%) completed MOEWS, with appropriate stabilization in 65/70(92.86%).

Conclusions: Implementation of MOEWS improved women's care through action being taken on abnormal observations. Before whole-scale adoption of

MOEWS in low resource settings, this study should be scaled up and repeated to ensure replicable findings.

Synopsis

Implementation of a modified obstetric early warning system in Zimbabwe improved action on abnormal observations**.** This simple system can empower staff and improve care.

Introduction

Quality of care is gaining increasing attention globally as policymakers, managers and clinicians acknowledge that improved care can lead to better outcomes for patients. During the Millennium Development Goals campaign there was a 47% decline in the number of maternal deaths worldwide, [1] however this is far short of the 75% decrease which was set as the target for 2015. In trying to meet this goal, several countries in sub-Saharan Africa introduced policies of removing user-fees for maternity services and, unsurprisingly, this has increased demand for care.[2]

In Zimbabwe, maternity services were made free in 2012. This has resulted in increased demand and therefore staff are under more pressure. In this environment, simple decision support tools can help staff to identify and then prioritize unwell patients.

Tools such as Early Warning Scores (EWS) were developed in order to facilitate the timely presence of appropriately skilled staff to attend clinically deteriorating patients.[3] They provide the opportunity to aggregate the impact of sometimes subtle deterioration in physiological observations into an overall score which, when abnormal, is used to prompt a clinical response.[4] Many different EWS systems exist. A recent review of their impact has suggested that there is a trend towards improved patient outcomes with their use.[4] However, the unique physiology of pregnant women is not accounted for in the EWS designed for the general population, and it does not effectively

identify at risk patients.[5] Modified Obstetric Early Warning Systems (MOEWS) have been widely used in the United Kingdom since they were recommended by the National Confidential Enquiry into Maternal Deaths in 2007.[6] A tool based on similar principals a ‘Maternal Early Warning Trigger’ has recently been evaluated in the United States, and has shown a reduction in maternal morbidity. [7] These tools have not been widely used or evaluated in resource poor settings.

The MOEWS charts advocated for in the 2007 Confidential Enquiry[6] are a simplified EWS, using a color coded method of red and amber scores, rather than a numerical system. If one physiological observation falls into the ‘red’ section of the chart (significantly abnormal) or if two observations are in the ‘amber’ area (slightly abnormal), a clinical review is required. This system is less complicated than some of the other maternal trigger systems that have been developed, [7-9] and therefore was selected for this study as the most suitable tool for introduction in this low-resource, high pressure setting.

In 2011 a health-partnership between the Zimbabwean referral hospital and a UK teaching hospital was initiated. As part of this partnership PRactical Obstetric Multi-Professional Training (PROMPT) was initiated, and is ongoing. Alongside this, the Zimbabwean hospital began monitoring their outcomes using a maternity dashboard.[10] On a background of commitment to quality improvement, we designed this study to develop and implement a locally applicable MOEWS to see if patients could be better stabilized before transfer

to theatre and if more timely action could be taken when patients began to deteriorate.

Materials and Methods

MOEWS was adapted to and piloted in a Zimbabwean Government funded referral hospital. This hospital had a dedicated maternity unit with approximately 10,000 deliveries per year and a caesarian section rate of approximately 18%. The implementation of the adapted MOEWS was evaluated in three ways. Firstly, an observational before and after study of whether women were appropriately stabilized prior to transfer to theatre for caesarean section. The second part was a longitudinal ‘spot-check’ audit of use of MOEWS charts on the wards. Finally, there was the development of a quality indicator for ongoing monitoring of MOEWS use. This study took place between April 2013 and January 2014. All members of maternity staff had the opportunity to be included in the piloting process and department wide implementation was undertaken.

The first stage of the study, which took place in April 2013, was the adaption and implementation of the MOEWS chart. The Zimbabwean implementation team, made up of PROMPT faculty members, was given examples of MOEWS from the UK. These examples were provided in color and a variety of black and white designs. The team selected the color version and then adapted the MOEWS to make it relevant to their local setting, and identified a local printer. The proposed MOEWS chart was taken to a meeting of the

senior nursing staff who agreed on the content of the MOEWS charts and the implementation plan.

A piloting phase allowed all members of staff working in the unit to input into the final version of the charts. Initially charts were given to staff on the wards for their feedback. Then draft charts were then placed on the wards for staff to use, with short introductions to the charts given to the staff by the implementation team. To facilitate the pilot stage, questionnaires were administered to all available staff on the wards. The questionnaires explored whether the staff knew what MOEWS were and where to find them. It also asked if they found them useful and if the trigger system facilitated the review of patients, there was the opportunity for free text feedback and further comments. Once further adaptions had been made, the Zimbabwean implementation team planned a launch event. They also designed a MOEWS training session to be delivered during the regular PROMPT training course in order to ensure all staff were familiar with how to use the MOEWS.

Although the implementation team was composed of PROMPT faculty members, the intervention was a new addition to PROMPT. PROMPT had been used by the hospital as a method to deliver onsite annually updated training to staff since 2011. Due to its regular place in the hospital calendar, and the fact that all staff were released to attend training annually [10], using PROMPT as a way to train staff in MOEWS was considered practical by the MOEWS implementation team.

In order to measure any immediate change in practice following implementation of the MOEWS charts, the quasi-experimental before and after study was undertaken. This examined the effect of MOEWS on the patients transferred to theatre for a caesarean section. In particular we examined whether they were appropriately stabilized prior to transfer. Notes were retrospectively reviewed at baseline (January-March 2013), and at 6 months post intervention (October-November 2013). A convenience sample of patient notes was used due to resource constraints. For practical reasons, notes were retrieved by hand from the administrative office and scanned until patients who had a caesarean section were identified. Data was extracted onto a proforma by AM and BTM and entered into Microsoft Excel. Descriptive statistics, Chi-Square tests and logistic regression techniques were used to understand whether pre-operative stabilization of patients occurred more frequently after MOEWS implementation.

The second part of the study was the 'spot-check' audit, designed to enable quick monitoring of whether ward patients had observation charts, whether the observations 'trigger' an action according to the MOEWS chart, and whether there was timely action on abnormal observations. Action was considered to be taken if the member of clinical staff providing care documented an action in response to the abnormal observation. This audit was planned for baseline and then on a monthly basis for 6 months. Data was collected on a simple form and entered into Microsoft Excel. Descriptive statistics were calculated to understand the number of women with observation charts, the number with observations that trigger action and the

number of women with action taken across the months. Chi squared tests were used to compare the baseline group to post-implementation groups in the follow-up period.

Following the initial observational study, the implementation team wanted to look at the longevity of the changes, and embed ongoing evaluation of the intervention. Therefore the third part of this evaluation, a quality indicator was developed in order to provide the team with a simple way to monitor the use of the MOEWS and any ongoing change in practice. This indicator was measured on a monthly basis from August 2014 until January 2015, by the MOEWS implementation team. It was carried out when a team member was able to complete the audit (taking into consideration their clinical workload) and incorporated the notes of the patients on the ward on that day.

The quality indicator captured the usage rate of charts (Number of cases with correctly completed MOEWS charts/Number of cases reviewed), whether healthcare staff took appropriate action to abnormal observations (Number of cases in which action was taken/Total number of charts requiring action) and the timeliness of the action if it is required (Total number where action was taken within the required timeframe/Total number where action was taken). Simple descriptive statistics were used to allow the implementation team to assess ongoing use of the MOEWS.

All analyses were completed using Stata Version 13 (StataCorp, College Station, Texas, 2013).

This improvement initiative was approved by the Mpilo Central Hospital Management and as such no ethical approval was sought. As the intervention was a department wide change initiative, no individual consent was obtained.

Results

MOEWS was adapted in April 2013 by the MOEWS implementation team, then a team of senior midwives at the hospital made further changes and approved the pilot chart. Changes from the UK example MOEWS included that they would be used for antenatal admissions, high risk, high dependency and post-theatre patients only, due to resource constraints. There was a decision to add ‘edema’ to the chart as a possible predictor of pre-eclampsia as urinalysis sticks are not reliably available to measure proteinuria. There was also an alteration of the ‘amber’ levels on the blood pressures to bring it in line with Zimbabwean guidelines. After a discussion about the ability to measure oxygen saturations, the team decided it should remain on the charts but they were aware that it was a measure that would not be recorded outside theatre due to lack of appropriate equipment. They also introduced box for staff to complete following action on abnormal observations.

A short pilot of the charts was undertaken and feedback on the charts was collected and the overall results of the questionnaires staff completed are displayed in table 1. Reasons midwives found the chart useful included: “most information compressed and easy to evaluate at a glance” and “they alert the nurse and alerts us on when to tell the doctor”. The midwives on the ward felt

a space to record fetal heart rate should be added. Another issue raised by midwives during this early piloting phase was the need for training “Midwives, doctors and students in the maternity department could be taught on charting as some errors are made leading to wrong scoring e.g. recording a systolic BP and diastolic BP in the same column”. The doctors found that it was useful to have the “ability to follow a patient in time”. They found the charts “… easy to correlate with the clinical picture” and that abnormal observations are “…usually an indicator that action has to be taken or patient has to be monitored closely”. Like the midwives they felt that “it is a good monitoring tool if properly followed” and that “everybody should have training in the MOEWS chart”. The changes suggested from the feedback were made at a final MOEWS produced for rollout (Supplementary Material S1).

The caesarean section theatre transfer study included 78 women in the before and 80 after implementation. There was no difference in the age of the patients in each group (p=0.195). There was a significant increase in the proportions of patient’s undergoing pre-operative stabilization after the intervention was introduced (18/79(22.78%) vs 37/85(43.53%) p=0.005). Even after controlling for patient age, participants in the post-intervention group were more likely to be stabilized prior to caesarean section (OR 2.78 95% CI 1.39, 5.54). There was no difference in operation type, anesthesia delivered, or estimated blood loss (EBL) or complication rates from caesarean section between the two groups (P>0.050). Demographic and comparison data for the operating obstetricians were not available.

In the longitudinal study, there were 43 women in the baseline group and 85 included in the follow-up period. Figure 1 shows the change in action recorded following the implementation of the MEOWS chart. Before the intervention there were no formal observation charts and observations were written directly into the notes. After the intervention, 78/85(91.76%) of patients had MOEWS charts in their notes and 64/85(75.29%) of the charts were used appropriately. When dichotomizing the patients into groups before or after the intervention, there was no difference in the number of women who triggered the MOEWS score (p=0.252), however there was an increase in the proportion of women that had recorded action taken after implementation 1/24(4.17%) vs 28/45(60%) p=0.001.

The quality indicator tool, designed to measure ongoing change in practice, revealed that in the six month period of its intial use, 78/125(62%) had completed MOEWS charts. Of these patients action was taken in response to 65/70(92.86%) of patients triggering on the MOEWS chart. All of these patients received a clinical action within the recommended time frame.

Discussion

This implementation study has shown that through a partnership approach it is possible to implement a decision support tool in a Zimbabwean hospital, which can aid with the recognition of unwell patients and action being taken to halt their deterioration.

The success of this study undoubtedly relied on the fact that the adaption of the MOEWS and the implementation plan were led entirely by the Zimbabwean team. However, a limitation may be that the exact figures selected as cut offs in the chart, were not evidence based.

A further strength is that the Zimbabwean team played an active part in the ongoing monitoring of the implementation of MOEWS and are continuing to do this. However, the utility of this quality indicator may be reduced because it does not incorporate all of the patients on the ward on the day of measurement, rather a brief snapshot. It is however a pragmatic indicator, which allows the implementation team to quickly assess the ongoing use of the MOEWS.

The fact that this improvement project was undertaken in partnership has allowed knowledge and skills to be transferred between the UK and Zimbabwe team. This includes the fact that some of the Zimbabwean suggestions for the MOEWS charts (e.g. addition of an action taken box) are also being considered by the clinical team in the UK.

The training to use the MOEWS charts was embedded within the ongoing obstetric emergency training programme ‘PROMPT’. This does mean that MOEWS as a stand-alone initiative has not been investigated in this study. This may bias the findings in this study because the PROMPT training ensured that there were enthusiastic champions to take the initiative forwards and also meant that there was an approved and well attended forum for

providing the required local training to the maternity team. However, the training was a stand alone element of the programme and therefore could feasibly be delivered without the remainder of the PROMPT intervention.

The implementation of MOEWS was carried out at low cost, which makes it a feasible intervention to consider implementing more widely. The main cost of implementing the MOEWS is the printing of the charts, which as it was arranged locally, in bulk and therefore relatively inexpensive at approximately 0.04 USD per chart. However, even this small cost is likely to be difficult to meet in the poorest settings.

As was found in the UK [11] the midwives did not want to use the MOEWS for every patient, but instead because of limited resources (utilization of charts as well as time) wanted to use them on a selected group of patients. This limits the potential of the MOEWS to be a safety net to identify the 'normal' women who begin to develop complications. This may be the reason that the simplistic quality indicator performed so poorly with respect to the completion of charts post intervention as some of the patients in the study may not have met the basic requirements to be allocated a MOEWS chart.

A further limitation is that this pilot was undertaken on one maternity ward. However, it was in a government hospital with 10,000 deliveries per year. If it is possible to implement the charts at a busy unit like this, it may well be possible to implement the charts at other units where there are dedicated maternity staff and a high throughput of patients. Due to time and resource

constraints we were unable to investigate whether it is feasible and useful at smaller centers, where there are no dedicated maternity staff.

There is a lack of high-quality evidence relating to the MEOWS. The UK version has been shown to be a useful bedside predictor of maternal morbidity,[12] however as of yet this tool has not been validated in a low-resource setting. Therefore, before whole-scale adoption of this decision support tool in low resource settings, this adapted MOEWS should be validated and this study should be scaled up and repeated to ensure replicable findings in other settings.

Conflict of Interest

AM, JC and TS are members/trustees of the PROMPT Maternity Foundation, they have no financial interest in the association. The remaining authors have no conflict of interest to declare.

Authors Contribution

JC conceived the implementation project. AM, BTM, SMo, TS, JC designed the study. AM, BTM collected the data. AM and SMe analyzed the data. AM wrote the first draft of the paper and all authors critically revised the draft.

Acknowledgements

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403 Table 1: Feedback from Midwives and Doctors during the pilot phase.

MOEWS chart:	**Midwives(n=15)**	**Doctors(n=9)**
Knowledge of	13(87%)	8(89%)
Location of	14(93%)	7(78%)
Useful	13(87%)	9(100%)
Receive/provide advice/review following trigger	3(20%) always 12(80%) sometimes	4(44%) always 5(56%) sometimes
Suggested improvements	6(40%)	4(44%)

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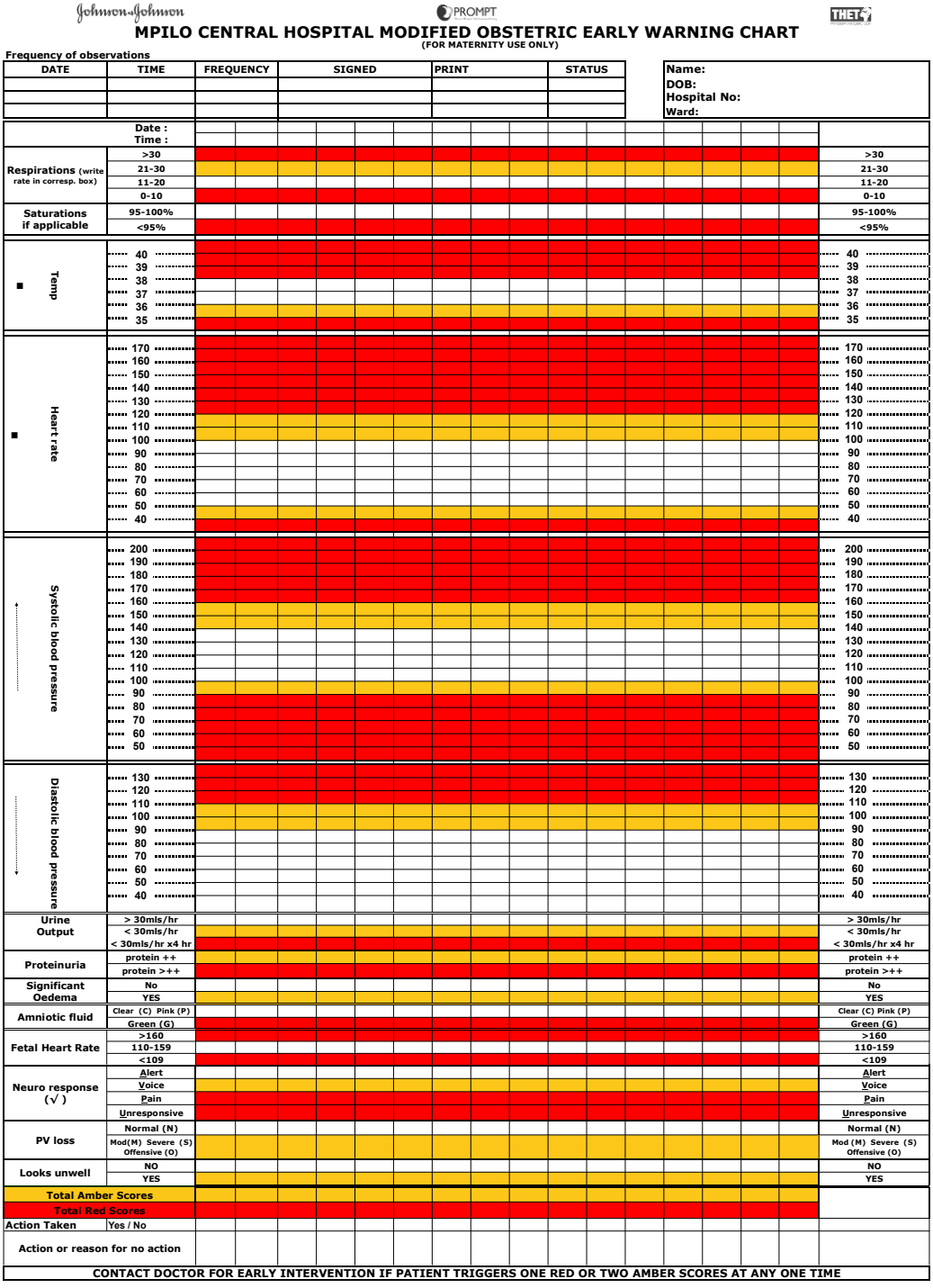
406 Supplementary material S1: Modified Obstetric Early Warning System

407 (MOEWS) Chart



Johnson & Johnson PROMPT THET

MPILO CENTRAL HOSPITAL MODIFIED OBSTETRIC EARLY WARNING CHART

(FOR MATERNITY USE ONLY)

Frequency of observations

DATE	TIME	FREQUENCY	SIGNED	PRINT	STATUS

Name:
DOB:
Hospital No:
Ward:

	Date : Time :																		
Respirations (write rate in corresp. box)	>30																		>30
	21-30																		21-30
	11-20																		11-20
	0-10																		0-10
Saturations if applicable	95-100%																		95-100%
	<95%																		<95%
Temp	40																		40
	39																		39
	38																		38
	37																		37
	36																		36
	35																		35
Heart rate	170																		170
	160																		160
	150																		150
	140																		140
	130																		130
	120																		120
	110																		110
	100																		100
	90																		90
	80																		80
	70																		70
	60																		60
	50																		50
	40																		40
Systolic blood pressure	200																		200
	190																		190
	180																		180
	170																		170
	160																		160
	150																		150
	140																		140
	130																		130
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	110																		110
	100																		100
	90																		90
	80																		80
	70																		70
	60																		60
	50																		50
Diastolic blood pressure	130																		130
	120																		120
	110																		110
	100																		100
	90																		90
	80																		80
	70																		70
	60																		60
	50																		50
	40																		40
Urine Output	> 30mls/hr																		> 30mls/hr
	< 30mls/hr																		< 30mls/hr
	< 30mls/hr x4 hr																		< 30mls/hr x4 hr
Proteinuria	protein ++																		protein ++
	protein >++																		protein >++
Significant Oedema	No																		No
	YES																		YES
Amniotic fluid	Clear (C) Pink (P)																		Clear (C) Pink (P)
	Green (G)																		Green (G)
Fetal Heart Rate	>160																		>160
	110-159																		110-159
	<109																		<109
Neuro response (√)	Alert																		Alert
	Voice																		Voice
	Pain																		Pain
	Unresponsive																		Unresponsive
PV loss	Normal (N)																		Normal (N)
	Mod(M) Severe (S) Offensive (O)																		Mod (M) Severe (S) Offensive (O)
Looks unwell	NO																		NO
	YES																		YES
Total Amber Scores																			
Total Red Scores																			
Action Taken	Yes / No																		
Action or reason for no action																			

CONTACT DOCTOR FOR EARLY INTERVENTION IF PATIENT TRIGGERS ONE RED OR TWO AMBER SCORES AT ANY ONE TIME

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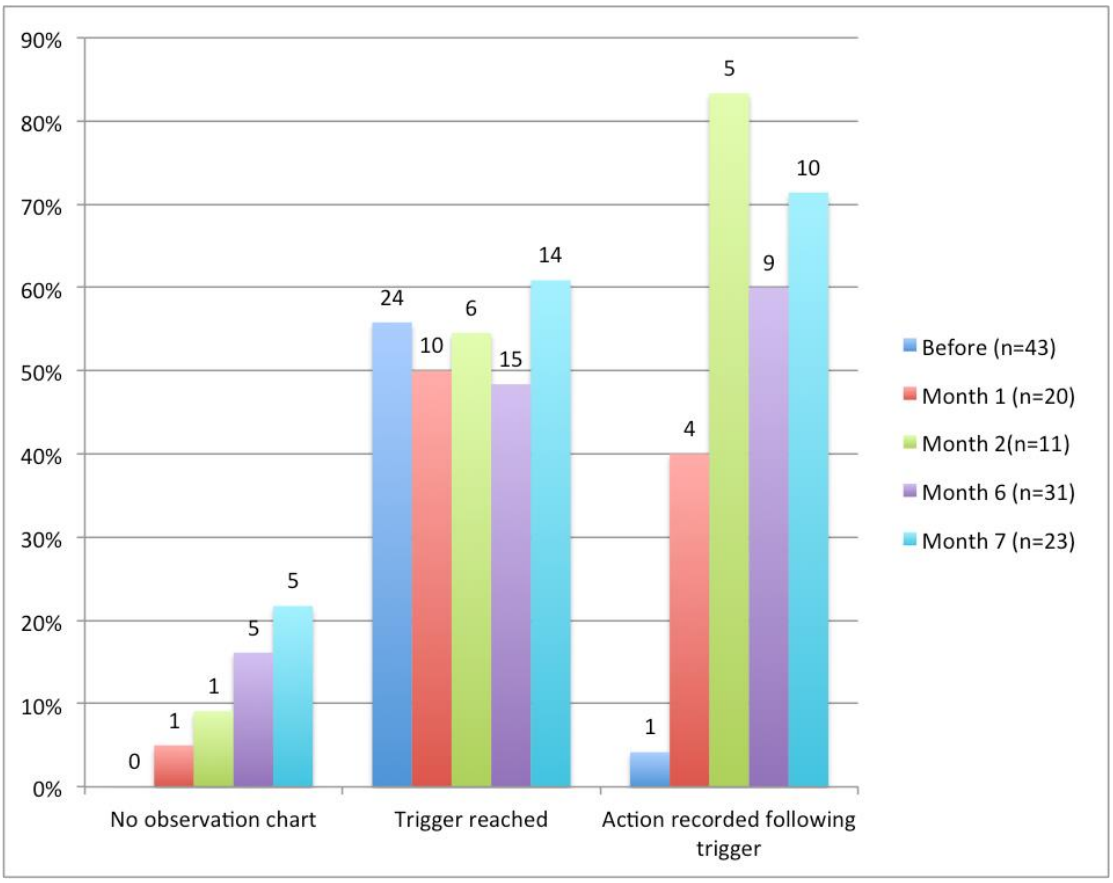
409 Figure 1: Graph to show the utilization and action on the MOEWS charts over

410 time.



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