

BEST PRACTICE  
IMPLEMENTATION STRATEGY  
IN THE USE OF OXYTOCIN  
DURING LABOUR

*“submitted in partial fulfilment of the requirements of the Degree  
of Doctorate in Pharmacy.”*

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2024



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To Margie

## Acknowledgements

I would like to thank Professor Lilian Azzopardi for her guidance and support throughout this journey. Thank you to Professor Yves Muscat Baron for his professional help. Heartfelt thanks to Professor Liberato Camilleri for his invaluable help with statistics.

Thank you to the midwives who helped me in this project, especially Mary and Josephine. Thank you to all the staff at Medical Records, especially Janet and Margaret, for their invaluable help in my study.

Sincere gratitude to Dustin for his constant support, motivation and inspiration. Thank you to Debbie for her continuous support and encouragement. Thank you also to Yakof and Mario. I cannot forget my work colleagues, whose backing made it possible for me to carry out my studies. Thank you, Grace and Mario, for being you. I would also like to thank my closest friends for their endless support.

Deepest gratitude to my parents Stephen & Monica and my sister Gabriella for their support, and to my twin-sister Sarah whom I embarked on this journey with, and to Margie my furry buddy who always pushed me through in her own ways.

## Abstract

Globally there is a general lack of uniformity in Oxytocin (OT) concentrations, doses, rates, and duration of infusion for the induction (IOL) and augmentation (AOL) of labour. This project was set to analyse the local use of OT for IOL and AOL with the scope of developing a Best Practice Implementation Strategy for OT use during parturition. The study was divided into three main parts.

During the first part of the study, a literature analysis was undertaken to identify a suitable quality metric for OT use. The second part consisted of application of the identified quality metric to undertake a local gap analysis. In the third part, data was collected retrospectively from the year 2022, using a purposefully developed data collection tool, from 355 patient cases who met the inclusion criteria, which included low-risk, cephalic pregnancies.

The 'Safe Administration of Oxytocin Implementation Toolkit' developed by the Provincial Council for Maternal and Child Health<sup>1</sup> (PCMCH) Ontario, Canada, was identified as being the most appropriate quality metric tool for gap finding. Out of a total of 27 criteria addressing 11 different best practice recommendations, 7 were unmet, 7 were partially met and 13 were met. The gap analysis exercise indicated that local practice fulfils most of the required clinical checks, however the recommendations that were unmet or partially met were mostly related to the documentation domain. The compiled retrospective data of the 355 participants was divided into 2 groups according to use of OT. This high alert drug was used in 63.9%

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<sup>1</sup> PCMCH. Safe Administration of Oxytocin Implementation Toolkit. Ontario. 2022 [cited 5 May 2024]. Available from: [https://www.pcmch.on.ca/wp-content/uploads/Safe\\_Administration\\_Oxytocin\\_Implementation\\_Toolkit\\_Final\\_January\\_2022\\_v2.pdf](https://www.pcmch.on.ca/wp-content/uploads/Safe_Administration_Oxytocin_Implementation_Toolkit_Final_January_2022_v2.pdf)

(N=227) of the cases, 43.6% of which were inductions N=99. A higher use of OT was statistically significantly associated (p value <0.05) with greater gestational age, higher parity, increased frequency of uterine contractions, higher incidence of late decelerations or variable decelerations with concerning features, and higher use of epidural analgesia (EDA).

The Best Practice Implementation Strategy developed for the delivery suite was evaluated for practicality and applicability by an expert panel consisting of four obstetricians, four senior midwives and two pharmacists. The Strategy developed focused on optimising practice through the development of checklists, adopted from the 'PCMCH toolkit', to support documentation, better infusion labelling and independent verification checking procedures to reduce risk of errors. Subsequently, sessions were carried out with midwives working within obstetric wards to disseminate the Strategy by sensitising the safe use of OT and the implementation of the identified checklists.

This study provided an insight into current practices of OT use including identification of further need of improvement in documentation systems. The developed Best Practice Implementation Strategy builds on the current good practice identified and provides measures to increase system robustness in ensuring standardised patient safety practices.

**Keywords:** Oxytocin, high-alert, labour, standardisation, best-practice recommendations, patient safety

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## List of Abbreviations

|                |                                          |
|----------------|------------------------------------------|
| <b>AOL</b>     | Augmentation of Labour                   |
| <b>AS</b>      | Apgar Score                              |
| <b>ASD</b>     | Autism Spectrum Disorder                 |
| <b>ADHD</b>    | Attention Deficit Hyperactivity Disorder |
| <b>CTG</b>     | Cardiotocography                         |
| <b>BF</b>      | Breastfeeding                            |
| <b>EDA</b>     | Epidural Analgesia                       |
| <b>EL/LSCS</b> | Elective Low Segment Caesarean           |
| <b>EM/LSCS</b> | Emergency Low Segment Caesarean Section  |
| <b>FIP</b>     | International Pharmaceutical Federation  |
| <b>GABA</b>    | Gamma-aminobutyric acid                  |
| <b>GDM</b>     | Gestational Diabetes Mellitus            |
| <b>IOL</b>     | Induction of Labour                      |
| <b>IUGR</b>    | Intrauterine Growth Restriction          |
| <b>LD</b>      | Labour Dystocia                          |
| <b>MDH</b>     | Mater Dei Hospital                       |
| <b>NPICU</b>   | Neonatal Paediatric Intensive Care Unit  |
| <b>NS</b>      | Normal Saline                            |
| <b>NVD</b>     | Normal Vaginal Delivery                  |
| <b>OT</b>      | Oxytocin                                 |
| <b>OTR</b>     | Oxytocin Receptor                        |

|               |                                    |
|---------------|------------------------------------|
| <b>PG</b>     | Pituitary Gland                    |
| <b>SmPC</b>   | Summary of Product Characteristics |
| <b>SyntOT</b> | Synthetic Oxytocin                 |
| <b>WHO</b>    | World Health Organisation          |

# 1.INTRODUCTION

This first chapter gives a comprehensive review of the literature, together with the rationale of the study. Areas of discussion include the lack of standardisation of Oxytocin (OT) use during labour, the classification of OT as a high-alert drug, the different OT regimens followed and potential undesirable events following OT. At the end of the chapter, the aims and objectives of the study are discussed.

## 1.1 Background

Since its synthesis by Sir Vincent du Vigneaud in 1953, for which he was awarded the Noble prize in 1955 (Carter, 2023), OT has been widely used during parturition. Even though a lot of years have passed since discovering OT, several areas pertaining to its safe use and its effects on the central nervous system and any potentially resulting complications remain understudied. Although the most widely researched and known actions of OT relate to the reproductive system, this peptide hormone exhibits a plethora of other OT-mediated functions namely social behaviours and other physiological functions including a decrease in fear, pain and stress, which functions can be negatively altered for long-term following the use of exogenous OT in the delivery room. Such understudied areas include how the administration of synthetic OT (SyntOT), also referred to as peripheral OT, impacts maternal postpartum mental well-being and the development of maternal postpartum disorders including fear and anxiety issues or neonatal neurodevelopmental disorders including autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD) and seizure disorders, attachment, bonding and breastfeeding (BF) issues (Rashidi et. al., 2022). Bodies of evidence point put how the drug most frequently linked to avoidable adverse perinatal outcomes is in fact claimed to be intravenous (IV) OT (Clark et al., 2009; Cluver and Odendaal, 2010; Rooks, 2011; Ragusa and Svelato, 2014).

Locally, at Mater Dei Hospital (MDH) Syntocinon® 10 units/mL Concentrate for solution for infusion is used, which is licensed for both antepartum and postpartum indications. As listed in the Summary of Product Characteristics (SmPC) for Syntocinon®, “antepartum uses of OT include IOL for medical reasons e.g. in cases of post-term gestation, premature rupture of the membranes, pregnancy-induced hypertension; stimulation of labour in hypotonic uterine inertia; Early stages of pregnancy as adjunctive therapy for the management of incomplete, inevitable, or missed abortion. Postpartum uses include during caesarean section after delivery of the child and for the prevention and treatment of postpartum uterine atony and haemorrhage”. The recommended concentration of the infusion concentration stated in the SmPC of the product is that of 5 units in 500 mL of physiological solution.<sup>2</sup> As stated in the current OT local protocol, 10 units of OT are added to 500 mL of sodium chloride 0.9%. Such a concentration is recommended in the SmPC in the event of intrauterine death (IUD) or for induction of labour at an earlier gestational age. A local study (Falzon 2021) showed that the average gestational age for N = 305 was that of 39.35 weeks, so the suggestion in the SmPC regarding labour induction at earlier stages in pregnancy was not applicable.

## 1.2 Endogenous vs Exogenous Oxytocin

Both endogenous and exogenous OT act on Oxytocin Receptor (OTR) system in-vivo, but, in a different manner. OT receptors are not only expressed in the uterus and mammary glands, but also in other areas such as the ovaries, testes, kidneys, thymus, pancreas, and heart (Hermesch, 2023). SyntOT exerts effects on the OTR that endogenous OT does not, thereby

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<sup>2</sup> Electronic Medicines Compendium (eMC). Syntocinon 10 IU/ml Concentrate for Solution for Infusion-Summary of Product Characteristics (SmPC) [Internet]. UK: Datapharm Ltd.; 2023 [cited 15 March 2024]. Available from: <https://www.medicines.org.uk/emc/product/9735/smpc#gref>

eliciting or repressing certain outcomes. One such different outcome is the different pattern in contractions observed with SyntOT, as documented by Daly et al. (2020).

Through such patterns, there is more signalling in the uterus, which in turn causes more pain and higher stress levels to the mother. This increased frequency of uterine contractions does not leave enough time for the mother to rest between contractions, increasing the uterine resting tone, compromising foetal blood supply (Daly et al., 2020).

The increased sensation to pain leads to the more frequent use of pharmaceutical analgesia during labour, including epidural analgesia (EDA) to help the mother cope with contractions. This is not only because of the more intense, more frequent contractions but also because of the reduced natural pain coping mechanisms, which do not occur in the presence of exogenous OT. The endogenous pain reduction mechanism is driven by the inhibition of the  $\beta$ -adrenergic receptors and the reduction in clearance of endorphins, especially the  $\beta$ -endorphin. This gives rise to the increased level of plasma endorphins and their binding to opioid receptors on the uterus, resulting in pain reduction. Such a process does not occur in the presence of exogenous OT (Khajehei, 2017). This phenomenon was proven in 1985 by Genazzani and colleagues (Genazzani et al., 1985) who reported constant levels of  $\beta$ -endorphins in mothers who were administered SyntOT, unlike parturients who were not administered OT exogenously. They also mentioned that the administration of exogenous OT, along with consequential decrease in B-endorphins during labour can lead to tocophobia, which is when a mother is fearful and anxious about childbirth (Esan et al., 2021). Such findings were corroborated by Petraglia and colleagues in 1986.

**Table 1.1: SyntOT vs Endogenous OT: Differences between the two forms of OT**

*Adapted from: Khajehei, M. Labour and beyond: The roles of synthetic and endogenous oxytocin in transition to motherhood. British Journal of Midwifery. 25. 230-238.10.12968/bjom.2017.25.4.230. doi:10.12968/bjom.2017.25.4.230*

| Endogenous OT                                 | Exogenous OT                                                                                 |
|-----------------------------------------------|----------------------------------------------------------------------------------------------|
| Modulating neuroendocrine reflexes            | Uterine contractions                                                                         |
| Preparation of foetal neurons for birth       | Birth of the baby                                                                            |
| Uterine contractions                          | Potentially increasing the foetus's vulnerability to hypoxic brain damage                    |
| Birth of baby                                 | Myometrial ischaemia                                                                         |
| Facilitating milk ejection and breast-feeding | Increased sensation of pain                                                                  |
| Maternal behaviours                           | Likelihood of abnormal foetal heart rate (FHR) patterns, foetal distress and uterine rupture |
| Bonding and attachment                        | Impaired lactation and breast-feeding                                                        |
| Establishing social behaviours                | Maternal postpartum anxiety and depression symptoms                                          |
| Partner and offspring preference              | Minimal affectionate touch and low levels of attachment behaviour and social synchrony       |
| Endorphin Effect                              | Increase in Pain sensitivity                                                                 |

IV OT administration requires continuous cardiotocographic (CTG) monitoring, limiting maternal movement during labour, which movement could otherwise help the parturient to cope better with pain. Contrastingly, the use of EDA can also prompt OT use due to decreased sensation in the lower spinal segment, causing unsatisfactory contractions (Walter et al., 2021). Table 1.1 summarises dissimilarities between the two forms of OT.

Although OT can be lifesaving when used meticulously in clinically justified situations, the strong potential to cause negative outcomes in other bodily pathways immediately after birth or later in life, both at maternal and off-spring end, warrants the need for more awareness about SyntOT and its more controlled use (Jurek and Neumann, 2018). One example relates to the size and solubility of both molecules. The physiological disruption brought about by exogenous OT causes negative feedback and hinders endogenous OT release (Omaru et al., 2024). Maternal, endogenous OT can pass through the placenta and foetal blood brain barrier positively affecting the brain of the unborn foetus, making the former less prone to suffer hypoxic damage during delivery following numerous nervous system changes in the foetal brain involving gamma-aminobutyric acid (GABA). Such changes start one day before the proper onset of physiological labour and reach the highest point during the second stage of parturition. The ability of SyntOT to exert the same effect is disagreed upon. Theoretically, as found by (Khajehei, 2017), due to the nature of the relatively large size of the molecule and its hydrophilicity, SyntOT is unable to cross the BBB, (although low levels of SyntOT have been found in the brain of the foetuses in animal studies) so such protective effects do not occur, making the foetus more susceptible to hypoxic damage during delivery. In turn, this may cause myometrial ischaemia which can in turn negatively impact foetal oxygenation which then gives rise to abnormal foetal heart rate patterns leading to foetal distress and /or uterine rupture (Uvnäs-Moberg, 2023).

### 1.3 Lack of Standardisation of Oxytocin use During labour

Local and international studies indicate lack of standardisation of the use of OT to induce or augment labour particularly in the domains involving dose, concentration, rate, and duration of infusion (Hayes and Weinstein, 2008; Rooks, 2011; Krening et al., 2012; Hidalgo-Lopezosa et al., 2016; Drummond, 2018, Daly et al., 2020). The need for OT infusion regimen standardisation has been ongoing as early as the 1900s with the aim of reducing the induction-delivery period without increasing the risk of any OT-associated complications. Thornton and colleagues stated in 1993 that OT concentrations during spontaneous labour remain particularly low, whereas the plasma levels with the use of SyntOT for the IOL or AOL are significantly higher. Approximately 14 units (28 micrograms) of endogenous OT are stored in the human posterior PG (Rashidi et.al., 2022).

The unstandardised use of OT, especially when different protocols are followed within the same institution, increases the possibility for OT overuse (Daly et al., 2020) and for medication errors. In 2008, the latter was stated to be the eighth leading cause of death in the United States (Hayes and Weinstein, 2008). The most common medication errors that occur with OT use during parturition are dose related issues and failure to timely identify and treat tachysystole, both of which could easily be avoided (Simpson and Knox, 2009). There have been several attempts in compiling a harmonised guideline for OT use during labour, however after more than 70 years after the first clinical use of OT, this has not yet been achieved (Daly et al., 2020). Despite no consensus concerning nursing and physician OT practices, institutions offering labour and delivery services are urged to make use of this uterotonic drug in a standardised manner to safeguard efficacy and patient safety (Hayes and Weinstein, 2008; Drummond, 2018). Through the varied, individualised use of OT during

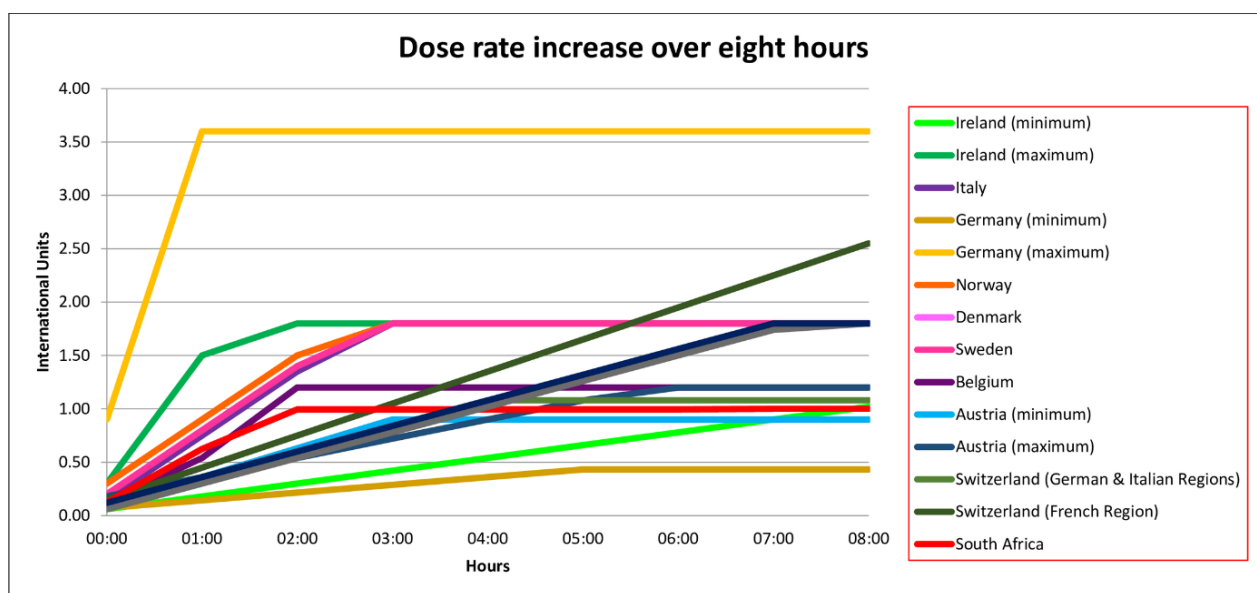
parturition, which is based on medical judgement and experience best practice is not guaranteed (Freeman and Nageotte, 2007).

Hayes and Weinstein (2008) suggested that OT use is standardised through a dilution of 10 mU/mL, with an initial dose of 2 mU/min which is to be increased by 2 mU every 45 minutes until satisfactory labour is achieved or up to a maximum dose of 16 mU/min. This is similar to the current local protocol followed at MDH (20 mu/ mL). Ten units of OT are diluted in 500 mL normal saline. The initial rate is 6 mL per hour and this may be doubled every 15 minutes until regular contractions are established or up to a maximum of 96 mL/hr (MDH, n.d.).

Some published international OT protocols (Table 1.3) are divided according to parity; nulliparous vs multiparous and according to indication; IOL vs AOL. Such a model is not reflected in all OT guidelines/protocols, which increases the propensity for patient harm.

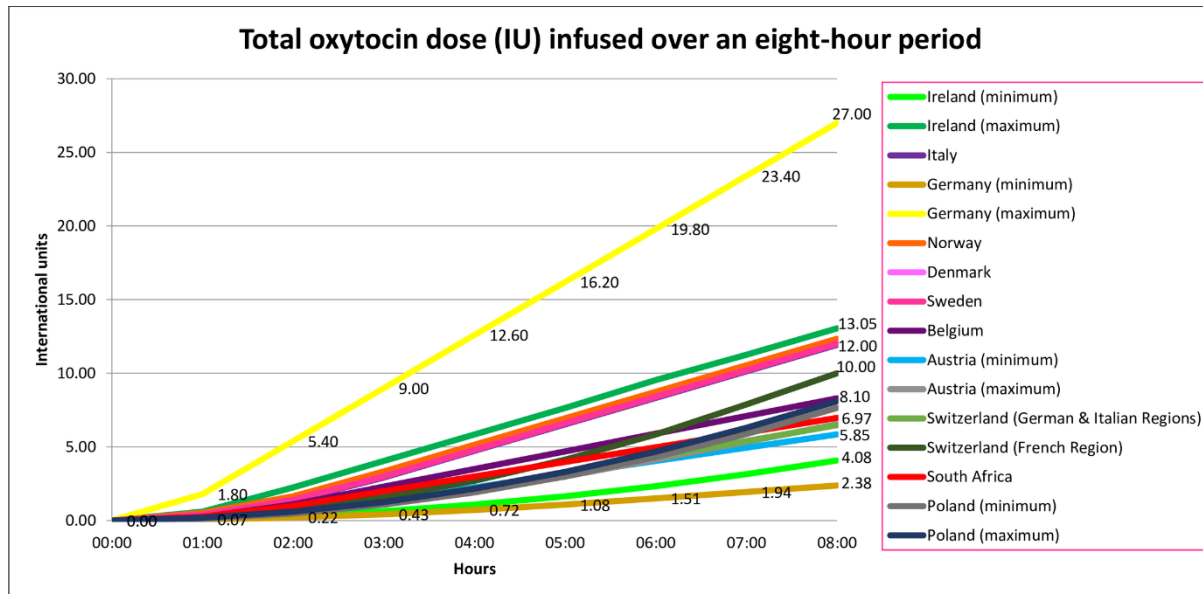
An observational study across 11 European countries and South Africa as part of the COST Action IS1405 (BIRTH) (2014–2018) compared SyntOT regimens infused during parturition as well as the units escalation rate (Figure 1.1) and the total units infused over eight hours of labour (Figure 1.2) (Daly et al., 2020).

An 11-fold difference was documented in the total amount of units oxytocin infused over eight hours ranging from 2.38 units to 27.00 units, (both of which values belonged to Germany's regimens), a total variation of 24.62 units. The lowest starting dose of 0.06 units per hour was reported in Ireland's and Poland's minimum regimens whereas the highest starting dose was reported in Germany's maximum regimen. Escalation intervals ranged between 15 to 60 minutes (Table 1.2).



**Figure 1.1: Dose rate increase over 8 hours across different countries**

Adopted from: Daly D, Minnie KC, Blignaut A, Blix E, Vika Nilsen AB, Dencker A, Beeckman K, Gross MM, Pehlke-Milde J, Grylka-Baeschlin S, Koenig-Bachmann M. How much synthetic oxytocin is infused during labour? A review and analysis of regimens used in 12 countries. *PloS one*. 2020 Jul 28;15(7): e0227941. <https://doi.org/10.1371/journal.pone.0227941>



**Figure 1.2: Total OT dose infused over 8 hours across different countries**

Adopted from: Daly D, Minnie KC, Blignaut A, Blix E, Vika Nilsen AB, Dencker A, Beeckman K, Gross MM, Pehlke-Milde J, Grylka-Baeschlin S, Koenig-Bachmann M. How much synthetic oxytocin is infused during labour? A review and analysis of regimens used in 12 countries. *PloS one*. 2020 Jul 28;15(7): e0227941.<https://doi.org/10.1371/journal.pone.0227941>

In light of the numerous negative outcomes, both short term and long term, as a consequence of using intrapartum SyntOT, it is suggested that the lowest effective dose is used in labouring women to prevent adverse effects including the alteration of physiological processes in both mother and off-spring. The global extensive dissimilarity in SyntOT doses suggests potential overuse across and within institutions.

**Table 1.2: International OT protocols**

Daly D, Minnie KC, Blignaut A, Blix E, Vika Nilsen AB, Dencker A, Beeckman K, Gross MM, Pehlke-Milde J, Grylka-Baeschlin S, Koenig-Bachmann M. How much synthetic oxytocin is infused during labour? A review and analysis of regimens used in 12 countries. *PLoS one*. 2020 Jul 28;15(7): e0227941. <https://doi.org/10.1371/journal.pone.0227941>

| Country                 | Is there a national guideline? | Year | Oxytocin dose                | Infusion fluid                                                             | Amount   | Start dose                               | Escalation rate                                                                                                                                                                                                                                                                                                                               | Maximum dose                                                    | Is there a separate guideline for induction and acceleration (augmentation) of labour? | Is oxytocin titrated with uterine contractions? | How often are uterine contractions recorded? |
|-------------------------|--------------------------------|------|------------------------------|----------------------------------------------------------------------------|----------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------|
| Austria (Institution 1) | No                             | -    | 5 IU                         | 0.9% Saline or Ringer-Lactate                                              | 500 mls  | 9 mls/hour                               | 9 mls/hour, every 20 minutes                                                                                                                                                                                                                                                                                                                  | -                                                               | No                                                                                     | Yes                                             | Continuously                                 |
| Austria (Institution 2) | No                             | -    | 5 IU                         | Electrolytic solution (e.g., ELO-MEL isoton or Ringer-Lactate "Fresenius") | 500 mls  | 18 mls/hour                              | 20 minutes                                                                                                                                                                                                                                                                                                                                    | 90 mls/hour                                                     | No                                                                                     | Yes                                             | Continuous CTG                               |
| Austria (Institution 3) | No                             | -    | 5 IU                         | Elo-mel                                                                    | 500 mls  | 18 mls/hour                              | 6 mls/hour                                                                                                                                                                                                                                                                                                                                    | 120 mls/hour                                                    | Yes                                                                                    | Not stated                                      | Continuous CTG                               |
| Belgium (Institution)   | No                             | 2017 | 10 IU (1m IU = 2 drops (dr)) | Glucose 5% in Saline 0.45%                                                 | 1000 mls | 12 mls/ hours, 4 dr/ minute, 2 mU/minute | After 20 minutes, 24 mls/hour, 8 dr/ minute, 4mU; After 40 minutes, 36 mls/hour, 12 dr/minute, 6 mU; After 60 minutes, 54 mls/hour, 18 dr/minute, 9 mU; After 80 minutes, 84 mls/hour, 28 dr/minute, 4 mU; After 100 minutes, 120 mls/hour, 40 dr/minute, 20 mU; At 120 minutes, 180 mls/ hour, 60 dr/ minute, 30 mU (only on medical advice) | 120 mls/hour or 20 mU/ minute = 2 mls/ minute = 40 drops/minute | Yes                                                                                    | Yes                                             | Continuous monitoring                        |

|                                                   |                                            |      |                  |                                          |          |                                                           |                                                                                                                                                                            |                                     |                                                |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                  |
|---------------------------------------------------|--------------------------------------------|------|------------------|------------------------------------------|----------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cyprus<br/>(institution)</b>                   | No                                         | 2016 | 2.5 IU or<br>5IU | Hartmans,<br>Dextrose 5%,<br>Saline 0.9% | 500 mls  | Unclear                                                   | Unclear                                                                                                                                                                    | Unclear                             | No                                             | Yes                                                                                                                                                                                                                                                                                                        | Early first stage<br>every 15<br>minutes. Late<br>first stage every<br>5–10                                                                                                                                      |
| <b>Denmark<br/>(National)</b>                     | Yes, on<br>augmentation<br>of labour only. | 2014 | 10 IU            | 0.9% Saline                              | 1000 mls | 3.3 mU/<br>minute (20<br>mls/hour)                        | 3.3 mU/minute<br>(20 mls per hour)<br>every 20 minutes                                                                                                                     | 30 mU/<br>minute (180<br>mls/ hour) | Guideline on<br>augmentation of<br>labour only | Unclear. There<br>is no mention<br>of the amount<br>of oxytocin<br>infused per<br>minute in<br>relation to<br>contractions.<br>However, the<br>guideline<br>stresses that<br>the infusion<br>should only be<br>escalated until<br>there is a<br>maximum of 5<br>contractions<br>in a 10-minute<br>interval | The guideline<br>stresses that<br>there should be<br>no more than 5<br>contractions<br>within a<br>10-minute<br>interval but<br>does not<br>mention any<br>systematic<br>recording of<br>uterine<br>contractions |
| <b>Germany<br/>(institution)<br/>(minimum)</b>    | No                                         | -    | 6 mU/ml          | Ringer<br>solution                       | 500      | 15 mU/<br>minute                                          | 15 mU/minute<br>every 20 minutes                                                                                                                                           | 60 mU/<br>minute                    | Not stated                                     | Yes                                                                                                                                                                                                                                                                                                        | Continuous<br>CTG                                                                                                                                                                                                |
| <b>Germany<br/>(Institution)<br/>(maximum)</b>    | No                                         | -    | 60 mU            | Saline 0.9%                              | 50       | 1 mU/<br>minute                                           | 1–4 mU/minute<br>every 20 minutes                                                                                                                                          | -                                   | -                                              | -                                                                                                                                                                                                                                                                                                          | -                                                                                                                                                                                                                |
| <b>Ireland<br/>(National and<br/>institution)</b> | Yes                                        | 2016 | 10 IU            | 0.9% Saline                              | 1000 mls | 1–5 mU/min<br>(6–30 mls<br>per hour)                      | 1–5 mU/minute<br>(6–30 mls/hour)<br>every 15–30<br>minutes                                                                                                                 | 30 mU/<br>minute (180<br>mls/hour)  | No                                             | Yes                                                                                                                                                                                                                                                                                                        | Measured over<br>15-minute<br>intervals                                                                                                                                                                          |
| <b>Italy<br/>(Institution)</b>                    | No                                         | 2018 | 5 IU             | 0.9% Saline                              | 500 mls  | 5 IU in 500<br>ml (10 mU/<br>ml) Saline at<br>15 mls/hour | 15 mls/hour every<br>15 minutes, up to<br>labour<br>contractions of,<br>normally, 3 strong<br>and regular<br>contractions<br>lasting approx. 1<br>minute in 10<br>minutes) | 180 mls/hour                        | No                                             | Yes                                                                                                                                                                                                                                                                                                        | Continuously,<br>via continuous<br>monitoring<br>EFM-CTG                                                                                                                                                         |

|                                    |     |      |         |                               |          |                                           |                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                               |            |     |                                                               |
|------------------------------------|-----|------|---------|-------------------------------|----------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|---------------------------------------------------------------|
| <b>Norway<br/>(National)</b>       | Yes | 2014 | 10 IU   | 0.9% Saline or Ringer-Lactate | 1000 mls | 5 mU/minute (30 mls/hour)                 | 2.5 mU/minute every 15 minutes                                                                                                                                                                                        | 30 mU/minute                                                                                                                                                                                                                                                  | Not stated | Yes | Every 15–30 minutes, always before increasing dose            |
| <b>Poland<br/>(Institution)</b>    | No  | 2017 | 5 IU/ml | 0.9% Saline, Glucose 5%       | 50 mls   | 5 IU in 50 mls Saline at 0.6–1.2 mls/hour | 1.2 mls/hour every 30 minutes, up to regular contractions (normally 3 strong and regular contractions lasting approx. 1 minute in 10 minutes)                                                                         | 18 mls/hour                                                                                                                                                                                                                                                   | No         | Yes | Continuously, via continuous monitoring CTG                   |
| <b>South Africa<br/>(National)</b> | Yes | 2016 | 5 IU    | Ringers Lactate               | 1000 mls | 25 mls/hour (2U/minute)                   | 50 mls/hour every 30 minutes—hospital guidelines: double every 30 minutes: start with 3 mls for 30 minutes, then 6 mls/hour, then 12 mls/hour, then 24 mls/hour, then 48 mls/hour, then 60 mls/hour after 30 minutes. | 200 mls/hour or 3–4 contractions >40 seconds. If the infusion rate reaches 200 mls/hour and strong contractions are not achieved, increase the dose by starting an infusion of 10 units in 1000 mls at 150 mls/hour, increasing to 200 mls/hour if necessary. | No         | Yes | Every 30 minutes for 10 minutes; continuous CTG, if available |

|                                                    |     |      |                                   |                    |                                                                                                |              |                                                                                                                                                                     |                                                                         |    |     |                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|-----|------|-----------------------------------|--------------------|------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sweden<br>(National)                               | Yes | 2011 | 5 IU (8.3 microgram/ml, 5 IU/ml)) | 0.9% Saline        | 500 mls (or 2 mls/1000 mls, 10 IU/1000 mls), (i.e., same concentration but in 500 or 1000 mls) | 20 mls/ hour | Increase with 20 mls/hour every 20 minutes                                                                                                                          | 180 mls/hour (can be raised after that but after doctor's order only)   | No | Yes | Measured over 10 minutes. There is no mention of how often contractions should be recorded but it states that there should also be a special checklist for oxytocin and that the contractions should be noted every time the oxytocin dose is changed and if not changed, every hour. |
| Switzerland<br>French speaking regions             | No  | 2012 | 5 IU                              | 0.9% Saline        | 500 mls                                                                                        | 30 mls/hour  | 15 mls/hour every 30 minutes. If there are >7 contractions in 15 minutes then no further escalation                                                                 | 360 mls/hour. Maximum total dose: 10 IU                                 | No | Yes | Measured over 15-minute intervals                                                                                                                                                                                                                                                     |
| Switzerland<br>German and Italian speaking regions | No  | 2012 | 5 IU                              | Ringerfundin Braun | 500 mls                                                                                        | 12 mls/hour  | 12 mls/hour every 30 minutes. If there are 3–4 contractions in 10 minutes, no further escalation; if there are >4 contractions in 10 minutes, reduce by 12 mls/hour | 108 mls/hour (0.018 IU/min), to be titrated for a maximum of 30 minutes | No | Yes | Measured over 10-minute intervals                                                                                                                                                                                                                                                     |

### 1.3.1 Different Oxytocin Protocols

Internationally, to date misadventures with exogenous OT are also tantamount to a number of obstetric medical malpractice claims and liability cases. Clark and colleagues stated that the individualisation, determined by experienced physicians does not necessarily reflect best practice. This alone should already instill the urge in all stakeholders to use this drug judiciously in safeguarding patient safety and prevention suboptimal clinical outcomes. The significant variations in practice as demonstrated by the several existing distinct protocols add on to this need.

Despite different OT protocols such as “Low Dose,” “High Dose,” and “Pit to Distress,” the consistency in the application of such protocols and the knowledge on their clinical benefits need to be harmonised. In Pitting to distress protocols, the OT dose is blindly, continuously increased until recording the 1-minute AS. Modern obstetric practice cannot be guided by such protocols (Clark et al., 2009).

**Table 1.3: Comparing different OT protocols**

*Adopted from: Falzon RM. Optimisation of oxytocin use during labour (Master's thesis, University of Malta).*

| <b>OT Administration Guideline</b> | <b>MDH, Malta</b>                | <b>Alberta Health Services, Canada</b>                   | <b>ACOG Practice Bulletin</b>                 | <b>Government of South Australia</b>                   | <b>Bolton, NHS Foundation Trust</b> | <b>Wrightington, Wigan and Leigh, NHS Foundation Trust</b> | <b>Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and the Clinical Strategy and Programme division, Health Service Executive</b> | <b>Auckland District Health Board, New Zealand</b> | <b>Tameside Hospital, NHS Foundation Trust</b> |
|------------------------------------|----------------------------------|----------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------|-------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------|
| <b>Preparation of Infusion</b>     | 10 units in 500 mL normal saline | 20 units in 1000 mL 0.9% NS or ringer's lactate solution | Generally, 10 units in 1000 mL 0.9%NaCl       | 10 units in 1000 ml of Hartmann's solution or 0.9 % NS | 30 units in 500mL 0.9% NS           | 10 units in 1000mL 0.9% NS                                 | 10 units in 1000 mL of 0.9% NS                                                                                                                                          | 10 units in 500 mL 0.9% NS                         | 10 units in 500 mL 0.9% NS                     |
| <b>Starting dose</b>               | 6 mL/hr                          | 1-2 mu/min i.e. 3 mL-6 mL/hr                             | Low dose; 0.5-2 mU/min<br>High-dose- 6 mU/min | 2 mU/min= 12 mL/hr                                     | 2 mL/hr= 2 mU/min                   | 10 mL/hr= 1.7 mU/min                                       | 1-5 mU/min= 6-30 mL/hr                                                                                                                                                  | 6 mL/hr= 2 mU/min                                  | 3 mL/hr                                        |

|                       |                                                                                            |                                         |                                                                                                      |                                                 |                                                                                                                                                                                                      |                                                                                |                                           |                                                                                                           |                                                                                                              |
|-----------------------|--------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Maximum dose</b>   | 96 mL/hr                                                                                   | 20 mU/min<br>i.e. 60 mL/hr              | Not established                                                                                      | 192 mL/hr=32 mU/min                             | Multiparous:<br>16 mL/hr<br>32 mL/hr<br>where effective contractions not reached at max dose<br><br>Nulliparous:<br>32 mL/hr<br>48 mL/hr<br>where effective contractions are not reached at max dose | 70 mL/hr = 11.9 mU/min<br><br>Higher doses might be used; 120mL/hr=20.4 mU/min | 30 mU/min= 180 mL/hr                      | 96 mL/hr= 32 mU/min                                                                                       | 60 mL/hr<br>Higher doses 72 mL/hr to 96mL/hr upon registrar approval                                         |
| <b>Dosage regimen</b> | Double every 15 minutes in certain situation start at 3 mL/hr and doubled every 30 minutes | Increase at 1-2 mu/min every 30 minutes | For High-dose regimen- increments of 3-6 mU/min every 15-40 min; low-dose 1-2 mU/min every 15-40 min | Increase at 12 mL/hr- 2 mU/min every 30 minutes | Increase by 4 mL/hr every 30 mins                                                                                                                                                                    | Increase by 10 mL/hr =1.7 mU/min every 30 mins                                 | 1-5mU/min (6 - 30 mL/hr every 15 - 30 min | For 6 mL/hr to 24 mL/hr increased by 6 mL/hr; for 36 mL/hr to 84 mL/hr increase by 12 mL/hr every 30 mins | For 3 mL/hr - 12 mL/hr rate is doubled every 20 to 30 minutes; for 24 mL/hr to 84 mL/hr increase by 12 mL/hr |

### 1.3.2 High Dose vs Low Dose

Tesemma et al. (2020) describe a low dose OT regimen as one having an initial dose of 2 mu/minute (6 mL/hr) increased by 2 mU/min every 30 minutes up to a maximum of 40 mU/min (120 mL/hr). A high dose OT regimen was described as one having Initial dose of 6 mu/min increased by 6 mU/min (18 mL/hr) every 20 minutes up to a maximum dose of 92 mu/min (276 mL/hr). A significantly shorter induction to delivery time was reported with the high-dose regimen. Ghidini and his team (2012) describe low dose protocols as those with a starting dose of 1-2 mU/min with incremental doses of 1-2 mU every 15-40 minutes. High-dose protocols are described as those having a starting dose of up to 6 mU/min (18 mL/hr) with incremental doses of 3-6 mU/min (9-18 mL/hr) at 15–40-minute intervals.

As stated in its SmPC, OT reaches a steady state within 20 to 40 minutes. Based on this property, regimes with dose-increase intervals of less than 40 minutes can be referred to as being blind procedures, whereby higher doses of the drug are administered before the full effect of the previous dose can be made observable (Clark et al., 2009).

High-dose and low-dose regimen for AOL are defined differently. For example, Son and colleagues in 2021 defined high-dose regimens for AOL as regimens with stating and incremental rates of 6 mu/min compared to standard dose regimes with initial and incremental rates of 2 mu/min. Zhang and his team (2011) considered high-dose OT regimen for AOL as one having initial and incremental rates of 4 mU/min, which was associated with a shorter first stage of labour with no increase in risk of LSCS or adverse perinatal outcomes. This classification of high-dose vs low-dose agrees with that reported by Kenyon et al. (2013). Results showed that a statistically insignificant correlation between the high-dose regimens and a shorter duration of labour (DOL) and less LSCS cases.

In a hospital-based cross sectional study carried out in Ethiopia in between May 2017 and May 2018, a significantly slightly longer average 'induction to delivery' time was reported for the low-dose OT group (5.9 vs 6.3 hours) (Tesemma et al., 2020) disagreeing with reports from Budden et al. (2014) (who classified regimens as low dose as those with < 100 mU OT in the first 40 minutes, and increments of <600 mU in the first 120 minutes) who reported no statistical differences between the groups. Successful induction rates and lower LSCS incidence were shown among the low-dose cohort (72.2% versus 61.1%) were documented by Tesemma et al. (2020). An analysis of 9 trials (2391 women) by Budden et al. (2014) documented a significantly higher rate of uterine hyperstimulation without FHR specifications and the associated risks for increased maternal and neonatal adverse outcomes with the high-dose regimen. In her report (on AOL), Kenyon and colleagues deciphered an association with a shorter DOL, less LSCS occurrence and more spontaneous vaginal deliveries when high-dose OT protocols are followed (Kenyon et al., 2013).

When Friedman's curve of normal labour was developed in 1955, normal progressing labour was defined as a cervix dilating at 1 cm/hr. At that time, women carried significant differences than women today. For example, nowadays women are more likely to be obese and to use pharmacological agents during labour and delivery than before, which factors affect the normal progression of labour. Such differences need to be acknowledged for practitioners to be in a better position to take the decision to apply interventions during labour namely IOL and AOL (Tillett, 2011).

The uterotonic in question has an unpredictable therapeutic index-meaning that the outcome in the mother can vary greatly between cases. For this reason, the OT infusion should be started at a relatively low dose, which is only to be increased in the event of

unsatisfactory progress of labour, which in turn is to be very thoughtfully decided upon.

Keeping in mind that the outcomes of OT could be detrimental or fatal and that they are dose-dependent, add on to the necessity for thoughtful dosing. Such disparities highlight the need for standardisation further including checklist-driven protocols to measure uterine and foetal response (Clark et al., 2009).

### 1.3.3 Discontinuation of Oxytocin at established Labour

Evidence suggests that stopping the infusion of OT once labour is said to be established the risk for the occurrence of adverse events is reduced and a more natural birth is experienced.

One study conducted by Jiang et al. (2022) performed a meta-analysis on 13 studies. They found that such discontinuation is significantly correlated with a reduction in LSCS delivery.

Rashidi et al. (2022) reported Boie et al's (2018) findings namely a reduction in LSCS incidence following IV OT discontinuation, but this reduction proved to be insignificant.

Contrastingly, a large trial carried out in 2021 reported a slight increase in LSCS incidence following OT discontinuation which was clinically and statistically insignificant (Girault et al., 2023).

Uterine tachysystole, postpartum haemorrhage (PPH), and abnormal FHR were significantly and negatively associated with OT discontinuation at 5 cm dilation, which findings were also reported by Boie et al. (2018) who analysed 10 randomised controlled trials. Although the induction to delivery time, which was analysed in 9 of the 13 studies, was shown to be significantly longer in the discontinuation group, the total DOL proved to be only marginally different (Jiang et al., 2022). Discontinuing IV OT seems to have marginal effects on the use of EDA (Boie et al., 2018).

A multicenter, randomised, open-labeled trial, The 'STOPOXY' trial was carried out in 20 maternity units across 15 cities in France between 2020 and 2022 to investigate the outcome of discontinuation of OT at 6 cm cervical dilation or more on neonatal morbidity. Results from this study did not show significant reduction in neonatal morbidity, mode of delivery, or PPH upon discontinuing IV OT (Girault et al., 2023). The 'CONSIDOX' trial is a double-blinded multicenter randomised controlled trial, which was carried out at Danish and Dutch Departments of Obstetrics and Gynaecology between 2016 and 2020 aimed to investigate the effect of the discontinuation of OT on LSCS. Results showed no statistical difference in LSCS incidence between the two groups, a longer DOL with OT discontinuation, reduced risk of hyperstimulation, FHR abnormalities and other maternal and neonatal outcomes (Boie et al., 2021). A secondary analysis of CONSIDOX aimed to develop an artificial intelligence (AI) model for the risk of LSCS in women with a cervical dilation of 6 cm after OT administration, using extreme gradient boosting to construct the prediction model. The model found that 7.6% of the mothers may have benefitted from OT continuations whereas 2.5% of the participants may have benefitted from OT discontinuation. Further studies are required to be able to implement such findings in clinical tools. Considering the results from various studies, further research is imperative to move towards OT standardisation (Girault et al., 2023).

## 1.4 Post Partum Haemorrhage

Albeit equivocal evidence, desensitization and downregulation of the G-protein coupled receptor OTR, which leads to the reduction of OT-mediated contractility may have important clinical implications relating to the prevention and treatment of PPH. This desensitisation process can be seen as a protective mechanism to prevent endogenous hyperstimulation (Maaliki et al., 2024). The prolonged exposure of the uterus to supraphysiologic concentrations of SyntOT for IOL or AOL reduces the immediate post-partum effectiveness of this drug (Alexander et al., 2024).

This desensitisation concept is important to consider during the IOL and the AOL, whereby the loss of response and decreased OTRs following prolonged exposure of the myometrial cells to exogenous OT can lead to more OT units being administered, which in turn would cause further loss of response, during which time the mother will experience more pain and require more pain relief methods, which interventions also influence labour (Arrowsmith and Wray., 2014).

One study reported that intrapartum exposure to exogenous OT for 12 hours or more is associated with increased quantitative blood loss and increased risk for PPH (at least 1000ml blood loss) in NVD (Alexander et al., 2024). This study is superior to other studies as OT exposure was assessed according to duration not as a binary exposure variable, as in other studies. In another study researchers found that the total duration and the cumulative dose of OT is clinically relevant to the development of PPH (Belghiti et al., 2011). Conversely, other studies reported no relationship between OT exposure and the risk for PPH (Sosa et al., 2009; Driessen et al., 2011; Foley et al., 2018). While results from a systematic review

conducted by Ende et al. (2021) classified SyntOT exposure as a 'likely' rather than a 'definite' risk factor for PPH, the meta-analysis did not result in an associations.

## 1.5 Oxytocin and Breastfeeding

Emerging reports investigate the effects of the administration of intrapartum OT on BF particularly as 'impact on BF' and 'impact on feeding behaviour of infants. Although conflicting data exists, one study published in March 2024 reports findings of other studies that deal with SyntOT leading to lower early postpartum BF rates. The association between SyntOT and impaired BF is believed to be dose-dependent (Olza Fernández et al., 2012). The primitive reflexes, which refer to the seeking, finding, and sucking of the newborns on the nipple of their mother have been shown to be compromised following SyntOT administration, both at 1 hour after birth and at 48 hours after birth. The latter happens because of a change in the neuroendocrine environment in the brain of the unborn child, which effect last for at least 48 hours (Omaru et al., 2024). Gomes et al. (2017) reported a correlation between SyntOT use and weakened neonatal sucking in the first hour of life, which result is corroborated by other studies (Olza Fernández et al., 2012; Bell et al., 2013; García-Fortea et al., 2014). Even though the stopping of BF at 3 months postpartum was shown to be more evident in the SyntOT group, no statistical significance was reported between the two variables (Gomes et al., 2017). This finding is consistent with results by Fernández-Cañadas Morillo et al. (2017).

Another visual investigational study conducted looked at such primitive reflexes during skin-to skin contact on the newborns within 2 hours of being born, categorised as those whose mother had been administered a low-dose, a medium-dose or a high-dose of SyntOT. Results showed that the time to start suckling and the effective suckling time were observed to be

longer and shorter respectively in offspring in the high-dose group. Such effects are thought to be dose dependent (Zhou et al., 2022).

A Japanese study by Omaru et al. (2024) investigated the influence of SyntOT (5 units in 500 mL in 5% glucose with an initial rate of 12 mL/hr and a maximum dose of 120 mL/hr) on feeding behaviour using more objective parameters namely the infant's Non-Nutritive Sucking under identical conditions using empty nipples. Following emergence of recent evidence that the formation of negative pressure for an intraoral vacuum is more important for effective feeding than the mandibular positive pressure, this study aimed to investigate the infant's oral cavity negative pressure during suckling. The objective assessment of the sucking pressure and sucking rhythm enabled the researchers to suggest effects of SyntOT on infants' feeding behaviour. Results showed significantly fewer total bursts (sucking movements), longer pause times (rest periods), and significantly more varied pause times in the OT group relative to the non-OT group.

How this is brought about can be explained by the following concepts. Prolonged exposure to SyntOT not only hinders the mother from producing her own endogenous OT, but also the foetus, thereby compromising the sucking reflex of the child. Omaru et al. (2024) also quotes a meta-analysis of animal studies that in turn reports a correlation between SyntOT and reduced food and water intake and reduced mealtimes. Such satiety and anorexigenic effects are corroborated by Lawson et al., 2017 and McCormack et al., 2020. The desensitisation phenomenon described in section 1.6 above also applies here, which results in deficient milk let-down reflex (Monks and Palanisamy, 2021).

A 2015 study by Marin Gabriel and colleagues demonstrated a negative correlation between SyntOT and anti-gravity reflexes of the neonate, after birth and at 3 months. Videotape

investigation of the first hour after delivery by Bell et al. (2013) showed that BF is heavily and negatively impacted following SyntOT administration, which correlation was observed 48hrs following delivery.

Another aspect which could contribute to the negative effects of SyntOT on BF is the antidiuretic effect of the molecule (owing to the structural similarity to vasopressin, also known as anti-diuretic hormone). Therefore, upon its administration, antidiuretic effects could be exhibited which could potentially lead to breast engorgement, complicating BF even further (Khajehei, 2017). The more intense, hence, painful contractions brought about by the administration of SyntOT lead to the mother being in distress, fear and anxiety (because of decreased  $\beta$ -endorphins during following SyntOT use), which also impacts BF. This is complemented by findings from Schwarze and her team who in 2014 reported that BF mothers appeared to be more relaxed than formula-feeding mothers, which has been accredited to higher levels of OT in the former group. A study by Jonas and colleagues (2009) showed an uplifted activity of the hypothalamic-pituitary axis resulting in the delayed onset of unsuccessful lactogenesis.

Lower AS (which is more likely with IOL and SyntOT administration) (Beebe et al., 2007) have also been shown to be correlated with impaired BF. Such a finding is also reported in the study by Guerra et al. (2009) and Matias et al (2010). Romano and Lothian (2008) reported that negative outcomes of IOL such as hyperbilirubinaemia (Trotman and Henny-Harry, 2012) or NPICU admission (Clark et al., 2009) contribute to impaired BF because of reduced alertness and coordination ability of the newborn.

## 1.6 Oxytocin and Postpartum Depression

Postpartum Depression (PD) is a form of depression that the mother can develop following childbirth. This is not the same as the anecdotal 'baby blues', which refer to the very varied moods the mother experiences because of the maternal changes in hormonal levels during this time. Such 'baby blues' decrease or disappear within 14 days after delivery. In PD, the mother experiences major depressive symptoms, which may develop as early as a few weeks after birth or after one-year post-partum, lasting from weeks to months to possible chronic depressive disorders. It affects 6.5% to 20% of women (Monks and Palanisamy, 2021). PD brings with it major consequences including general mental health decline, the inability of the mother to properly look after her child and the potentially lasting negative effects on the cognitive and social development of the child (Thul et al., 2020).

Clinical studies have shown positive correlations between low plasma oxytocin levels, abnormal maternal behaviour, and PD (Monks and Palanisamy, 2021). Such results are corroborated by Rashidi et al. (2022) who quoted conclusions from a study by Tichelman and colleagues in 2021 who had reported a weak, but significant association between SyntOT administration and postpartum depression. Kroll et al. (2017) reported a 32% higher risk of developing PD after being exposed to SyntOT and a 36 % risk increase in women who suffered from anxiety or depression before pregnancy. Gu and colleagues in 2016 carried out a cohort study that demonstrated a dose-dependent positive relationship between intrapartum OT and PD development at two months post-partum. They also reported, at two months post-partum, a lower endogenous OT production in mothers who had been administered SyntOT. Contrastingly, a prospective cohort study conveyed a reduced risk for PD development following SyntOT administration (Takacs et al., 2019). A randomised

controlled trial carried out in 2008 demonstrated a higher, but not significant occurrence of PD in mothers who had been administered exogenous OT earlier in labour 20% versus 15% in cases where SyntOT administration was delayed by 8 hours (Hinshaw et al., 2008).

Evidence shows that a relationship between exogenous OT and PD does exist. In view of conflicting evidence, more studies are required to clearly demonstrate such correlations.

This is of utmost importance as the negative consequences of PD on both mother and newborn are not to be underestimated. The bonding between the mother and the infant is heavily impacted mainly due to the decreased ability of the mother to respond to her child's needs, the decreased affectionate touching from the maternal end, and the decreased maternal self-confidence, disconnecting the pair. BF is also negatively affected in mothers suffering from PD. The child is more susceptible to; have difficulty in cognitive and emotional development, to miss developmental milestones, to have sleep disturbances, to encounter feeding problems, to have behavioral problems later in life and to have a weakened immune system, making the child more prone to falling ill (Saharoy et al., 2023).

### 1.7 Oxytocin and Neurodevelopmental Disorders

There seems to be conflicting and inconclusive evidence with regards to the relationship between the peripartum use of synthetic OT and the development of neurodevelopmental disorders (Giri et al., 2024) such as autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD) as well as problems pertaining to social behaviour and stress coping mechanisms. This negative influence could be brought about because of a disruption in the oxytocinergic system of the offspring, prompting genetic and epigenetic susceptibilities (Lønfeldt et al., 2019). Such effects are supported by Giri et al. (2024) whose study showed that elective induction using OT does have negative neurodevelopmental

outcomes on the newborn. It was demonstrated that SyntOT crosses the placenta, alters OTR gene and protein expression in the foetal brain and induces sex-specific abnormalities in neurobehavior and cortical connectivity.

Freedman and colleagues found in 2015 that children who were exposed to exogenous OT for IOL showed lower cognition which was measured as vocabulary tests and problem-solving ability. This research team also reported that the use of perinatal OT has been linked to a 2.4-fold higher risk of developing bipolar disorder. Following a longitudinal study, Guastella et al. (2018) reported statistical significance between OT augmentation and a higher Child Behaviour Checklist T-score of 60 or more relative to OT inductions and no OT groups, which checklist is made up of 118 behavioural or emotional problems that parents can rate as not true (score 0), somewhat or sometimes true (score 1) or very or often true (score 2). Results from this study showed that SyntOT administration was not shown to be associated with ASD or autistic-like traits. Kurth and Haussmann (2011) found a slim positive correlation between OT use for IOL or AOL and ADHD onset. Contrastingly, Silva et al. (2014), Henriksen et al. (2015) and Stockholm et al. (2021) disagree with such a finding. Giri et al. (2024) quotes a 23% increase in odds for developing ASD (Gregory et al., 2013), a 2-fold higher prevalence of abnormal autism-like behaviours in the offspring (Smallwood et al., 2016; Friedlander et al., 2017) and reduced school performance in twelve-year-olds (Burger et al., 2023).

Genetic factors like changes to OTR and changes to neuronal GABA signaling; and environmental factors such as maternal stress play an important role in ASD development (Lønfeldt et al. 2019). Studies reviewed by Lønfeldt et al. (2019) demonstrated minor association between peripartum OT use and ASD in the child, which finding was mirrored in

results published by Oberg et al. (2016). Kroll et al. (2017) reported a dose-dependent correlation between SyntOT use and ASD. A dose-dependent correlation between the factors in question was also reported by Soltys and colleagues in 2020., particularly among male offspring who were exposed for longer durations to high cumulative doses of SyntOT. Takayanagi and Onaka suggested in 2021 a positive feedback system between exposure to SyntOT at moderate doses in early life and long-lasting activation of the oxytocin system later in life. Conversely, they reported opposite effects following administration of high doses of SyntOT in early life. This suggests long lasting inhibitory actions on the OT system in adulthood following overactivation of OT neurons and or other stress-related systems activated by stressful stimuli in early-life. Such inhibitory actions may include the decreased expression of the OTR and endogenous OT synthesis. A 2024 study carried out by Diaz-Marsá et al. demonstrated that patients with borderline personality disorder and eating disorders had significantly lower OT plasma levels than the subjects in the control group. This could be attributed to the aforementioned statement pertaining to long lasting inhibitory actions on the OT system.

## 1.8 Cardiotocography Abnormalities

One of the most serious adverse events of OT is uterine hyperstimulation or uterine tachysystole (5 or more contractions in 10 minutes for at least 30 minutes), where immediate discontinuation of infusion is recommended.<sup>3</sup> FHR and uterine activity are monitored by means of CTG to help in the appropriate and timely interventions, which includes reducing or discontinuing the OT infusion (Preti and Chandharan, 2018). The

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<sup>3</sup> Electronic Medicines Compendium (eMC). Oxytocin 10 IU/ml Solution for infusion - Summary of Product Characteristics (SmPC) [Internet]. UK: Datapharm Ltd.; 2019 [cited 15 May 2024]. Available from: <https://www.medicines.org.uk/emc/product/9735/smpc>.

increased frequency and intensity of uterine contractions decreases placental oxygenation which may in turn lead to myometrial ischaemia which then gives rise to abnormal FHR patterns leading to foetal distress and /or uterine rupture. The hypoxia brought about can also lead to foetal acidosis (Khajehei, 2017).

Sukumaran et al. (2021) report that the use of high doses of OT and short intervals between OT doses during augmentation of labour both lead to increased uterine activity, increasing the risk of compromising foetal and/or maternal health. A past study shows that as labour progresses while OT is being administered, CTG abnormalities increase. Such abnormalities were more pronounced with more OT units administered (Jonsson, 2009). The risk for tachysystole is increased when high-dose protocols are followed, and oxytocin receptor sites are quickly saturated. A continual decline in foetal oxygen saturation has been demonstrated with increased uterine activity (Krening et al., 2012).

Continuous CTG monitoring is necessary during SyntOT infusion administration in view of the high propensity of the foetal wellbeing being compromised. CTG records FHR and uterine contractions by means of an ultrasound transducer, sometimes referred to as electric foetal monitor (EFM) which would be attached to the mother's abdomen. This enables the timely identification of and reaction to any abnormalities shown on the trace, the cardiotocogram (M'Barek et al., 2023). The NICE guideline, (on which local practice is based) on Foetal monitoring in Labour from 2022 lists four components of the CTG namely the uterine contractions, the baseline FHR, the variability, and decelerations. These should be monitored, documented, and classified as white, amber or red.

Having less than 5 uterine contractions in 10 minutes is classified as white, 5 or more contractions in 10 minutes is considered amber. Baseline FHR is the FHR over 10 minutes excluding accelerations and any decelerations. A white baseline FHR is classified as 110 to 160 bpm, amber is an increase in baseline FHR of 20 bpm from the onset of labour or since the last review in the past hours or 100-109 bpm or when the baseline cannot be determined. Baseline FHR is categorized as red when there is less than 100 bpm or more than 160bpm (NICE, 2022). The FIGO intrapartum CTG monitoring guidelines also define a normal baseline FHR to be between 110 and 160bpm. A value above 160bpm for more than 10 minutes is classified as tachycardia, while a value below 110bpm for more than 10 minutes is classified as bradycardia. Bradycardia could be brought about by several factors including maternal hypothermia, use of beta-blockers and foetal arrhythmias (Ayres-de-Campos et al., 2015). Variability is the difference between the highest heart rate and the lowest heart rate over 1 minute between contractions, excluding decelerations or accelerations. The white category states 5-25 bpm, an amber category states less than 5 bpm for 30 and 50 minutes or more than 25bpm for up to 10 minutes. The red category includes cases of either less than 5 bpm for at least 50 minutes, or more than 25 bpm for more than 10 minutes or a sinusoidal trace (NICE, 2022). Decelerations happens when the FHR decreases to baseline level by more than 15 bpm, each time lasting at least 15 seconds. The white category includes no deceleration, early decelerations, which are when the FHR decreases at the onset of a contraction and returns to baseline as soon as the contraction passes and non-concerning variable decelerations, which occur when the FHR slows down with a variable time in relation the contraction. In the amber class there are recurring variable decelerations with concerning features for less than 30 minutes, variable decelerations with concerning features for more than 30 minutes or recurring late

decelerations for less than 30 minutes. Decelerations are classified as red if they are recurring and variable with concerning features for more than 30 minutes, recurring late decelerations for more than 30 minutes or if there is acute bradycardia or a single prolonged deceleration lasting 3 minutes or more. Late decelerations are associated with foetal hypoxemia, hypercarbia and foetal acidosis.<sup>4</sup>

Accelerations are an increase in FHR by 15 bpm or more lasting at least 15 seconds. An overall normal CTG is obtained if all 4 features are in white categories. A suspicious CTG is one wherein any one feature is classified as amber and a pathological CTG is one where any feature is red or there are 2 or more features amber. Care is to be taken to note that interpretation of CTG during the different stages of labour differs. Conservative measures listed in the Nice guideline to target abnormal CTG include changing the maternal position, reducing or stopping the OT infusion or offering a tocolytic drug such as subcutaneous terbutaline.<sup>3</sup>

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<sup>4</sup> East Midlands Maternity Clinical Network & Senate NHS. Fetal Physiology in relation to Electronic Fetal Monitoring (EFM) [Internet]. NHS; 2019 [cited 8 June 2024.] Available from: [Fetal-Physiology-Handbook-13.02.19.pdf \(england.nhs.uk\)](#)

## 1.9 High-Alert Drug and Black Box Warning

IV OT was included in the United States Institute for Safe Medication Practices (ISMP) list of high-alert medications in 2007<sup>5</sup>, a characteristic which is reserved for only 12 other specific drugs. ISMP defines high-alert medications as drugs carrying an increased risk of significantly harming patients when misused and which may “require special safeguards to reduce the risk of error” (Culver and Odendaal, 2010; Rooks, 2011; Baber, 2011).

The inclusion of OT in the ISMP list of “High Alert Medications in Acute Care Settings,” as well as in the 2022-2023 Targeted Medication Safety Best Practices demonstrates that the use of this uterotonic drug raises several concerns related to what a safe dose would be, definition of safe frequency and intensity of contractions, situations triggering OT use, needs for a standardised concentration and how OT should be administered.

The strictest and most serious type of classification that the Food and Drug administration (FDA) gives to a medication is the Black Box warning. OT has been classified as such in view of the “serious or life-threatening risks” that it poses (Hayes and Weinstein 2008; Culver and Odendaal, 2010), recommending its use only in medically indicated IOL, not in elective IOL (Wang et al., 2022).

The indiscriminate use of OT during labour can lead to overuse and overdosing (Sanchez-Ramos et al., 2023). In addition to the rationale for use of OT in the local setting, variations in use of OT have also been described in a local study (Falzon, 2021). Clark and colleagues (2009) report that the underlying force behind the misuse of OT is its use for provider or patient convenience. They reported that they are unaware of another dangerous drug like

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<sup>5</sup> ISMP. ISMP List of High-Alert Medications in Acute Care Settings. ISMP; 2018 [cited 20 May 2024]. Available from: <https://www.ismp.org/sites/default/files/attachments/2018-08/highAlert2018-Acute-Final.pdf>

OT is used to accelerate a physiological process that if left to proceed on its own accord would still be completed, with the added benefit of having no adverse effects because of OT use. Normalisation of deviance is another contributing factor to OT misuse, which refers to not adhering to professional or technical guidance based on individual experience and the fact that such deviance results in an adverse outcome only rarely. For example, the foetus has the ability to tolerate hyperstimulation without becoming seriously hypoxic or acidotic. Such normalisation of deviance may also be the driving force to deviate from the required staffing ratios to women receiving SyntOT.

Every two years, ISMP develops a report titled 'Targeted Medication Safety Best Practices for Hospitals' (Figure 1.3) and for 2022-2023, one (new best practice 17) of the three New Best Practice highlighted deals with the use of OT.<sup>6</sup>

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<sup>6</sup> ISMP. Three New Best Practices in the 2022-2023 Targeted Medication Safety Best Practices for Hospitals. 2022 [cited 5 May 2024]. Available from: <https://www.ismp.org/resources/three-new-best-practices-2022-2023-targeted-medication-safety-best-practices-hospitals>

## New Best Practice 17

One of the new ISMP best practices is to safeguard against errors with oxytocin use. They recommend following these five steps:

1. Require the use of standard order sets for prescribing oxytocin antepartum and/or postpartum that reflect a standardized clinical approach to labor induction/augmentation and control of postpartum bleeding.
2. Standardise a single concentration/bag size for both antepartum and postpartum oxytocin infusions (e.g., 30 units in 500 mL Lactated Ringers).
3. Standardize how oxytocin doses, concentration, and rates are expressed. Communicate orders for oxytocin infusions in terms of the dose rate (e.g., milliunits/minute) and align with the smart infusion pump dose error-reduction system (DERS).
4. Provide oxytocin in a ready-to-use form. Boldly label both sides of the infusion bag to differentiate oxytocin bags from plain hydrating solutions and magnesium infusions.
5. Avoid bringing oxytocin infusion bags to the patient's bedside until it is prescribed and needed.

**Figure 1.3: ISMP New Best Practice 17 for 'Targeted Medication Safety Best Practices for Hospitals' report 2022-2023**

*Adapted from: ISMP. Three New Best Practices in the 2022-2023 Targeted Medication Safety Best Practices for Hospitals. 2022 [cited 2023 Jan 31]. Available from: <https://www.ismp.org/resources/three-new-best-practices-2022-2023-targeted-medication-safety-best-practices-hospitals>*

## 1.10 Institute for Healthcare Improvement

The root cause of the adverse events is the result of system failure, where individual failures would be the trigger.

The Institute for Healthcare Improvement (IHI) states that several medical malpractice claims pertaining to OT use, involving tachysystole, arise in different parts of the world, wherein more than 50% of the situations lead to birth trauma.<sup>7</sup> Such medical claims include claims of negligence in the event of undesirable events (Drummond, 2018; Freeman and Nageotte, 2007). Negative outcomes may not only arise during parturition or shortly after

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<sup>7</sup> IHI. How-to-Guide: Prevent Obstetrical Adverse Events.2012. [cited 5 May 2024]. <https://perigen.com/wp-content/uploads/2016/08/HowtoGuidePreventObstetricalAdverseEvents.pdf>

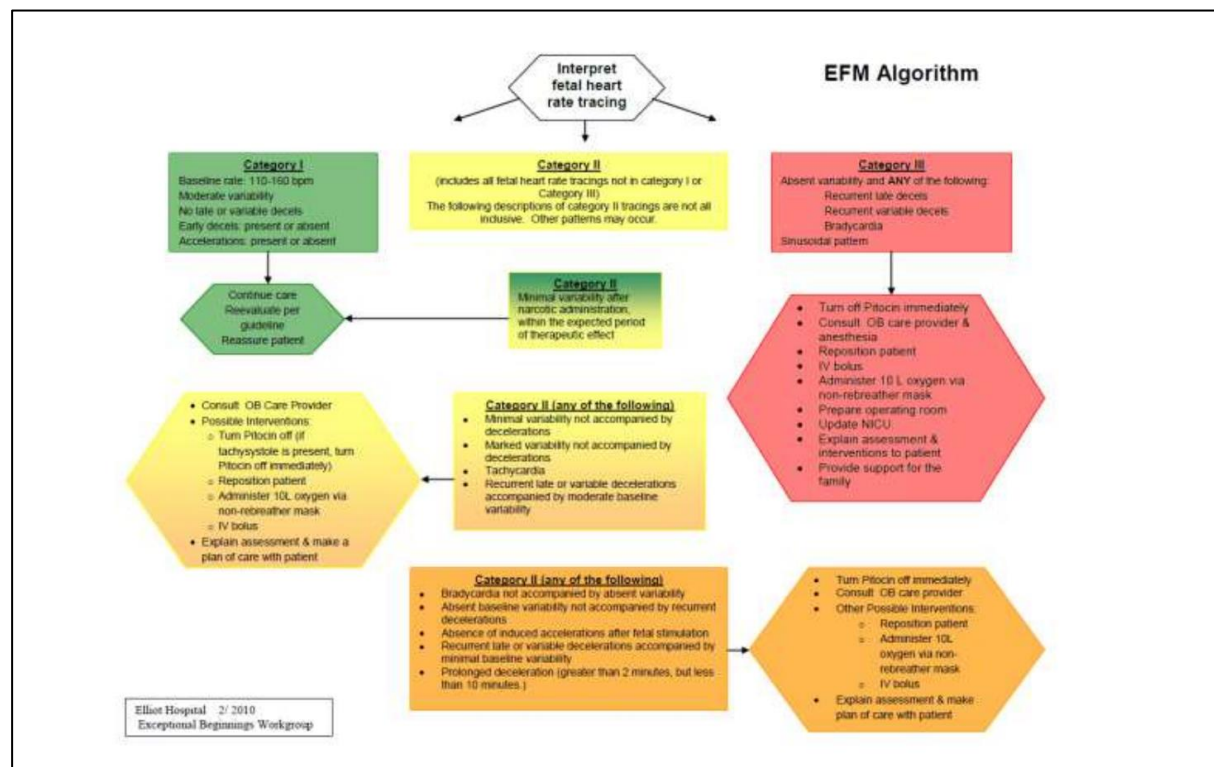
birth, but also later in life, due to a disruption in the control of natural hormones (Khajehei, 2017).

IHI aims to improve health care on a global scale by encouraging the implementation of several measures to safeguard patient safety. Evidence-Based interventions, so-called 'Bundles', developed by IHI aid in the fulfilment of such a goal. Founded in 2005, the IHI Perinatal Improvement Community specifically targets the delivery of perinatal care with "a goal of zero preventable injury".

The 'Elective Induction Bundle and the 'Augmentation Bundle', which both relate to the respective use of OT for the two indications, were compiled in 2004 and updated along the years as was deemed necessary. The 'IHI Elective Induction Bundle (Oxytocin)' highlights four elements for consideration when inducing labour with oxytocin; a gestational age greater than or equal to 39 weeks, the recognition and management of FHR status (NICHD Category I), pelvic assessment and identification and management of tachysystole.

Similarly, the IHI Augmentation Bundle (Oxytocin) has four elements: foetal weight estimate, recognition and management of foetal heart rate status (exclusion of NICHD Category III), pelvic assessment and recognising and managing tachysystole.

Post-Bundle Implementation audits have shown dramatic improvement in patient outcomes including a reduction in harm to less than 5% (as defined by the IHI Perinatal Trigger Tool5); less newborns requiring special care; better teamwork and communication; elimination of elective deliveries before confirming foetal maturity (usually at least 39 weeks gestation).



**Figure 1.4: IHI Electronic Foetal Monitoring Algorithm**

*Adopted from: Institute for Healthcare Improvement. How-to-Guide: Prevent Obstetrical Adverse Events.2012.*

The development of such bundles alone will not improve outcomes. This is merely possible following the “all-or-none” measurement criterion which refers to the reliable implementation of the whole bundle to all patients. This can only happen if all professionals in the care team work together, which brings us to the concept of multidisciplinary- A heterogenous structure with homogenous mindset and goals.

The above sections show us the importance of having standardised guidance when it comes to OT use during labour in line with best practice. The use of quality metric tools including checklists aids in adopting a standardised approach towards OT use.

Such key elements include having a standardised criteria for OT use, analyse any adverse events following OT use, have standing orders to manage tachysystole and OT infusion adjustment and review elective or medical inductions outside of protocol. This toolkit states that elective induction before 39 weeks is generally associated with negative neonatal outcomes (AHRQ, 2017).<sup>8</sup> The PCMCH in Canada issued an implementation toolkit on the Safe Administration of Oxytocin. Measures listed include In-use Oxytocin Safety Checklist, standardised order sets and standardised medication labels (PCMCH, 2022).<sup>9</sup> The use of OT in obstetrics healthcare systems requires standardisation through the development of practice strategies which take into consideration quality of service and patient characteristics.

Considering that this tocolytic is a high-alert drug with a high risk for patient harm, standardisation is the key instrument towards which we should move to limit drug misuse. Here we shall keep in view the Latin proverb, implying part of the hippocratical oath, that goes: 'Primum, non Nocere'- first do no harm- in this case we abide to preset harmonised guidance pertaining to OT use during labour to safeguard patient harm- mother, newborn and all those involved.

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<sup>8</sup> AHRQ. Toolkit for Improving Perinatal Safety. Rockville. 2017 [cited 5 May 2024]. Available from: Toolkit for Improving Perinatal Safety | Agency for Healthcare Research and Quality (ahrq.gov)

<sup>9</sup> PCMCH. Safe Administration of Oxytocin Implementation Toolkit. Ontario. 2022 [cited 5 May 2024]. Available from: [https://www.pcmch.on.ca/wp-content/uploads/Safe\\_Administration\\_Oxytocin\\_Implementation\\_Toolkit\\_Final\\_January\\_2022\\_v2.pdf](https://www.pcmch.on.ca/wp-content/uploads/Safe_Administration_Oxytocin_Implementation_Toolkit_Final_January_2022_v2.pdf)

## 1.11 Aims and Objectives

The research question of the study related to how close the local use of OT during labour is to Best Practice recommendations. This was investigated by identifying a suitable quality metric tool for the safe use of OT, carrying out a gap analysis exercise using the identified quality metric by analysing captured retrospective data from suitable patient cases over a calendar year (Jan-Dec 2022).

## 2.METHODOLOGY

In this chapter, the chosen study design, the inclusion, and exclusion criteria adopted, sampling techniques and study tools are described.

## 2.1 Setting

This study was carried out at the Department of Obstetrics and Gynaecology, MDH and at the Directorate of Pharmacy, MDH. All necessary approvals from Hospital Management and University of Malta Research Ethics Committee were obtained prior to commencement of the study (Appendix 1).

## 2.2 Study Design

The study is divided into three parts. For the first part, a literature review to identify quality metrics that are implemented to ensure the safe use of OT in different healthcare systems was undertaken. The robustness, feasibility and applicability of the metric identified were assessed. In the second part, the quality metric that was identified to be feasible for local application was implemented to identify gaps, after which a best local practice implementation strategy of standardisation of OT use was proposed. Risk minimisation strategies already in place pertaining to OT use were appraised. For the last part of the study, a retrospective OT- evaluation study was carried out, whereby participants were divided into two groups according to OT use as a cohort population (OT group and no OT group as a control group).

## 2.3 Quality Metric Identification

Quality Metric toolkits pertaining to OT use during labour were shortlisted. A simple google search was used in ensuring that the results generated are relatively easy to find. The keywords used were 'Oxytocin' and 'Toolkit'. Two relevant toolkits were found; 'Safe

Medication Administration: Oxytocin’ by the Agency for Healthcare Research and Quality-Safety Program for Perinatal Care, 2017 and ‘Safe Administration of Oxytocin Implementation Toolkit’ by the PCMCH, 2022.

## 2.4 Gap Analysis

The PCMCH toolkit was chosen as the most suitable to use in performing the local gap analysis. The latter was performed using the gap analysis template included within the toolkit (Appendix 4), through field observations on labour ward and discussions with senior midwives working on the same ward. The gap analysis template consisted of 11 best practice recommendations, which were sub-divided into 27 criteria, which could either be met, unmet or partially met.

## 2.5 Retrospective Study

The local use of OT was evaluated by analysing patient cases after specifying the inclusion and exclusion criteria as follows:

**Inclusion criteria:** all *singleton* births with *cephalic* presentation following *low risk* pregnancies that took place in 2022 at MDH. Low risk pregnancies were classified as pregnancies being free from any conditions listed on the blue card<sup>10</sup> from the obstetrics department, which could in some way influence labour. Most of these conditions will lead to the induction of labour at an early gestational age. Complications or ailments that arose during pregnancy namely gestational diabetes (GDM) or preeclampsia or intrauterine growth restriction (IUGR) were also excluded.

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<sup>10</sup> Blue card-a document in the mother’s file providing information on patient’s medical history, obstetric history and drug history.

**Exclusion criteria:** all *multiple pregnancies, non-cephalic presentations, non-low risk* pregnancies and births that were delivered by elective caesarean section (EL/LSCS), as this fell beyond the scope of the study because the mother would not have progressed to labour in a natural way. Cases of vaginal births after LSCS (VBAC) were also excluded as a different OT protocol is followed for such cases.

### 2.5.1 Sample Size Calculation and Randomisation

The complete list of deliveries carried out between January 1<sup>st</sup>, 2022, and 31<sup>st</sup> December 2022 amounted to 3,820 births. After filtering out EL/LSCS deliveries, 3,390 births were left for evaluation. A random representative sample was taken from the whole sample population. After discussing the general rule of acceptable margins of error i.e. 5-10% (Suresh and Chandrashekara 2012) the 5% margin of error was opted for. Using an online sample size calculator, the sample size was estimated to be around 350.

The remaining 3,390 births were randomised using the “=RAND ()” function in Microsoft Excel v. 2405, which works by assigning evenly distributed random values between 0 and 1 to the multiple cells. The randomly numbered cells were sorted according to the random number in ascending order so that the first 350 rows determined our cases.

In occurrences where a particular case met the exclusion criteria, for example a parturient with preeclampsia or GDM, or in the event of IUGR, the cases were omitted, and new ones were selected from the randomised list (i.e. the next row) to make up for the excluded ones and still have the targeted sample size.

### 2.5.2 Data Extraction

Data was extracted from pertinent patient files against a pre-set, data collection tool (Appendix 2). After reviewing the literature, a list of the most important factors that are influenced by OT was drawn up. Before the commencement of data collection, the data collection tool was discussed with four senior obstetricians, two senior midwives and two senior pharmacists, all working at MDH.

The data collection tool was converted into a Google form to ease data collection. A pilot-run was performed using the pre-designed Google form to check for feasibility and any potential necessary changes. Following successful piloting and some minor changes (addition of EDA or pethidine injection use questions) to the form, data collection was commenced and completed. OT used beyond the birth of the neonate i.e. OT used during the third stage of labour and post-partum OT use, was disregarded, as this was not relevant to the study.

### 2.5.3 Data Analysis

Collected data was linked to a Microsoft excel sheet v 2405, which data was then copied into SPSS Version 29 for data analysis. Several factors were tested for statistical significance with OT use and OT units using different statistical tests depending on the nature of the variables. The 0.05 level of significance was adopted throughout.

### 2.5.4 Calculating OT units according to local protocol

The amount of OT units administered to the participants at the different rates (6 mL/hr, 12 mL/hr, 24 mL/hr, 48 mL/hr and 96 mL/hr) were calculated (Figure 2.1). The total amount of OT units and the total duration of infusion were then calculated.

For example, if a mother was administered OT infusion at 6 mL/hr for 15 minutes;

10 OT units in 500mL 0.9% sodium chloride

? in 6 mL

$(10 \times 6) / 500 = 0.12$  units OT

0.12 units OT in 60 minutes

? in 15 minutes

$(0.12 \times 15) / 60 = \mathbf{0.03 \text{ OT units}}$

**Figure 2.1: Calculating OT units according to local OT protocol**

### 2.5.5 Statistical Tests

The Chi square test was used to investigate correlations between two categorical variables.

This test was performed for correlations between OT use and; nationality, maternal age, parity, decelerations, EDA, pethidine injection, mode of delivery, NPICU admissions and beat to beat variation.

The Spearman correlation coefficient ranges from -1 to 1 and it measures the strength of the relationship between two continuous variables. This was run to correlate the amount of OT units used with BMI.

The Independent samples t-test and the Mann Whitney test are used to compare mean scores between two independent groups (used oxytocin, did not oxytocin), according to the normality of the variable; independent samples t-test for normal distributions and the Mann

Whitney Test for skewed distributions. The Shapiro Wilk test was run to determine the normality of the variables. The independent samples t-test was carried out for correlations between OT use and gestational age, BMI, DOL, 1-minute and 5-minute AS and frequency of contractions.

The Kruskal Wallis test will be used to compare the mean amount of oxytocin used between three or more independent groups of participants clustered by their beat-to-beat variation.

This was carried out to correlate the mean amount of OT units with the beat the beat variation.

**Table 2.1: Correlating Factors with OT use**

*Factors that were correlated with OT use during the study*

| <b>CTG Factors</b>             |
|--------------------------------|
| Frequency of Contractions      |
| Decelerations                  |
| Baseline Foetal Heart Rate     |
| Beat to Beat variation         |
| <b>Other Factors</b>           |
| Parity                         |
| Maternal age                   |
| OT Indication                  |
| OT units                       |
| Duration of Labour             |
| Apgar scores (1 and 5 minutes) |
| BMI                            |
| Previous Mode of Delivery      |
| Present Mode of Delivery       |
| NPICU admission                |
| Pethidine Use                  |
| Epidural Use                   |

## 2.6 Best Practice Implementation Strategy

Following identification of gaps in local practice, tools from the PCMCH quality metric used in the study were discussed with the expert panel for possible implementation. Results from the retrospective fieldwork were used to create awareness about the potential negative outcomes of OT, to further highlight the importance of such a strategy.

An abstract was submitted and accepted (Appendix 6) to the 82nd International Pharmaceutical Federation Congress (FIP) 2024 for further dissemination of results to create more awareness about this high-alert drug.

### 3.RESULTS

In this chapter, the results for the three parts of the project are discussed. Findings from the gap analysis will be discussed. Statistical associations between any of the factors and OT use will be reported. The Best Practice Implementation Strategy proposed will be highlighted and measures on how to achieve and maintain optimised practice will be suggested.

### 3.1 'Safe Administration of Oxytocin'- Implementation Toolkit' PCMCH

The 'Safe Administration of Oxytocin-Implementation Toolkit', developed by the PCMCH in Ontario, Canada was identified by the researcher and the expert panel as being the more robust quality metric to carry out local gap analysis for the following reasons. It was developed in 2019, updated in January 2022 and evaluated in March 2023. This makes the toolkit relatively recent, compared to times of study. The aim of the tool, stated in the document itself states that:

*"This toolkit is intended to support hospitals in identifying which best practice recommendations to prioritize and implement. It aims to support implementation by providing tools that can be applied in practice, bridging identified gaps, and ultimately enhancing safety when administering oxytocin"*

The flow chart within the document on how to use the toolkit meets the aims of this project precisely. Another reason relates to the acceptance, effectiveness, and utility of such a toolkit, which were evaluated by means of a survey to 28 participating hospitals across Ontario i.e. almost one third of the province. The implementation toolkit in the participating hospitals has proven to be very successful as can be deciphered from statements which were obtained from the hospital surveys.

The PCMCH Toolkit also comprises information from the AHRQ toolkit, which was the second toolkit identified. Therefore, key elements from both tools are incorporated, giving it more value. It was the only tool that contained pre and in-use checklists (which are recommended to move towards a culture of safety when using OT (Sundin et al., 2018) as well as drug order sets and standardised medication labels, which made this toolkit the best option. Thus, it was chosen to be used as the metric to perform the gap analysis in this study to identify gaps in local practice, to select the tools to implement.

The Champlain Maternal Newborn Regional Program (CMNRP) 'Introduction Package Induction of Labour Toolkit'<sup>11</sup> (Appendix 5) was developed to complement the PCMCH toolkit. This was another reason which led to choosing the PCMCH Safe administration of Oxytocin Toolkit as the most suitable. The CMNRP toolkit itself is worth studying and be considered for implementation to reduce unnecessary IOLs, improving patient safety.

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<sup>11</sup> Champlain Maternal Newborn Regional Program. Introduction Package Induction of Labour Toolkit. Ottawa.2021 [cited 10 June 2024]. Available from: [http://www.cmnrp.ca/uploads/documents//Complete\\_Toolkit\\_August\\_2021.pdf](http://www.cmnrp.ca/uploads/documents//Complete_Toolkit_August_2021.pdf)

## 3.2 The Toolkit- Explained

The toolkit is based on 11 best practice recommendations (Figure 3.1) that were drawn up by clinical experts to encourage the safe use of OT. The toolkit is aimed at low-risk pregnancies which were defined as “pregnancies with a single cephalic, term pregnancy (at least 37 weeks gestation) and excludes conditions such as any diabetes, hypertensive disorders in pregnancy, placenta previa, pre-existing hypertension and IUGR”.

| <b>Safe Administration of Oxytocin: Best Practice Recommendations</b> |                                                         |
|-----------------------------------------------------------------------|---------------------------------------------------------|
| <b>1</b> Shared Decision Making                                       | <b>7</b> Standard Use of Oxytocin                       |
| <b>2</b> Inter-Professional Team Communication                        | <b>8</b> Independent Double-Check and Smart Pump Use    |
| <b>3</b> Indications for Induction or Augmentation                    | <b>9</b> Low-Dose Regimen                               |
| <b>4</b> Professional Skills Training                                 | <b>10</b> Stopping & Restarting Oxytocin Administration |
| <b>5</b> Hospital Preparedness for Adverse Events                     | <b>11</b> Patient Support in Labour                     |
| <b>6</b> Medication Handling                                          |                                                         |

**Figure 3.1: Safe Administration of OT- Best Practice Recommendations**

*Adopted from: PCMCH. Safe Administration of Oxytocin Implementation Toolkit. Ontario. 2022.*

The document is composed of the following tools and checklists to address each of these recommendations:

- A Gap Analysis template-which applies to all recommendations and is to be used by hospitals to identify the areas which require more attention for improvement.
- Patient Resources, including a patient education pamphlet and a 5-Question handout to be asked to patients to address Recommendation 1 to support the mother’s decision making and to inform the mother about the benefits and risks of OT.
- Communication Technique Examples such as the SBAR Tool, the I Pass the Baton Tool and the Team STEPPS system to address Recommendation 2, optimising inter-professional team communication.

- Two algorithms: 'Disagreeing with the plan of care' and 'Deciding about Medication Administration' to address Recommendations 2,3,4 to guide situations when there is a disagreement with the plan of care and to aid in decision-making among HCPs regarding OT use respectively.
- Pre-Use and in-use OT checklists adapted and validated by the HCA Perinatal Safety Initiative to address Recommendations 2,4,9,10 to reflect on the patient's eligibility to be administered IV OT and to reflect on instances when the infusion should be paused or stopped, or the dose decreased or increased.
- A Standardised Order Set to reduce medication errors, addressing Recommendations 7,8,9,10. The toolkit also contains a table for easy conversions from OT mU/minute to mL/hr.
- Standardised Medication Labels to ensure adequate labelling (Figure 3.4), in turn helping to prevent drug mix-ups, addressing Recommendation 6. To complement this, the toolkit includes a table to be used for independent double check for initial pump set up (Appendix 4).

In the gap analysis, the criteria were marked as either met, partially met or unmet. For the unmet criteria, recommendations were drawn up. Following compilation of all results, a Best Practice Implementation Strategy was proposed to improve patient safety.

### 3.3 Gap Analysis

The gap analysis exercise was performed using the PCMCH 'Safe Administration of Oxytocin Toolkit', field observations at the delivery suite and discussions with midwives. This was carried out to evaluate current local OT use. The current state of practice with respect to the recommendations listed in the metric were documented as being met, partially met or unmet. In instances where the recommendation was unmet or only partially met, actions that need to be taken were also listed.

From a total of 27 criteria, 7 were unmet, 7 were partially met and 13 were met (Table 3.1; Appendix 3).

**Table 3.1: Gap Analysis Results**

|                  | R1:<br>Shared<br>decision<br>making<br>(3) | R2: Inter-<br>Professional<br>Team<br>Communication<br>(3) | R3:<br>Indication<br>for IOL or<br>AOL (3) | R4:<br>Professional<br>Skills<br>Training (3) | R5: Hospital<br>Preparedness<br>for Adverse<br>events (2) | R6:<br>Medication<br>Handling (4) | R7:<br>Standard<br>use of OT<br>(2) | R8:<br>Independent<br>Double-<br>Check %<br>Smart Pump<br>Use (2) | R9: Low<br>Dose<br>Regimen<br>(1) | R10: Stopping<br>& Re-starting<br>OT<br>administration<br>(3) | R 11:<br>Patient<br>Support<br>in<br>Labour<br>(1) |
|------------------|--------------------------------------------|------------------------------------------------------------|--------------------------------------------|-----------------------------------------------|-----------------------------------------------------------|-----------------------------------|-------------------------------------|-------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------|----------------------------------------------------|
| Met              |                                            | 3                                                          | 1                                          | 3                                             | 1                                                         | 2                                 |                                     |                                                                   |                                   | 2                                                             |                                                    |
| Unmet            | 1                                          |                                                            | 2                                          |                                               |                                                           | 1                                 | 2                                   | 1                                                                 | 1                                 |                                                               |                                                    |
| Partially<br>Met | 2                                          |                                                            |                                            |                                               | 1                                                         | 1                                 |                                     | 1                                                                 |                                   | 1                                                             | 1                                                  |

**R= Recommendation**

**(Number of criteria per recommendation)**

The first recommendation: Shared Decision Making was only poorly met. Locally, no education pamphlets or leaflets or fact sheets are given to the mothers. The mother is only sometimes informed as to what is going to be administered to her i.e. Oxytocin, but no proper informed consent is given and documented by the most responsible physician (MRP). Other times, the mother is informed that the “drip” will be commenced to help the mother progress-sparing all detail as to what this “drip” is. Information about the benefits of OT is only sometimes briefly given to the parturient, but the potential risks are not exhaustively discussed. This sharing of information to the mother varies greatly between individuals. The educational material with the used toolkit could be employed locally to meet this recommendation, ensuring standardised dissemination of information to parturients.

Recommendation 2- interprofessional team communication, was fully met. MDH has an escalation process in place, whereby the midwife will inform her senior midwife on the shift, who will then escalate matters to the BST, HST or consultant as deemed necessary. A handover process is in place and ongoing interprofessional team training, and skills drills are provided and supported by clinical leadership.

However, there are no clinical-decision tools in place to be used in the event of disagreement with the care plan between different HCPs, namely between physicians and midwives. One senior practice midwife with whom the gap analysis was discussed claimed that there were times in the past when the midwives’ disagreement with the decision of the clinicians to start OT (depending on the situation) occurred very often and they did challenge such decision. Nowadays, midwives in general tend to follow more clinicians’ instructions without challenging, even when they come to a point of disagreement and believe otherwise. No checklists or other pre-set safety tools are used in local practice. Most

of the contents of the checklists are performed and are either documented in the patient's notes in the file or not documented at all. The assessment of the cervix to ensure a favourable cervix is carried out on labour ward, however different practice between individuals exist. This last point is a very important one- if the cervix is unfavorable, starting OT infusion will not be effective.

Recommendation 4 was fully met. Interprofessional foetal heart surveillance training is provided every two years. Drug information is available for all staff at MDH. Pharmacists at Pharmacy MDH are also available to assist and help with medicines information round the clock. Training on the correct use of smart IV pumps is also provided for all staff. One recent training session which was organized relates to EDA administration.

The Central Delivery Suite, MDH, has one on-site operating theatre available for use in the event of Em/LSCS. There are no official policies and protocols in place to manage potential adverse events following IV OT. Midwives reported the reduction or stopping of SyntOT infusion when there are too many contractions in a 10-minute.

OT on the ward is stored in the fridge in the ward's treatment room, along with other medications requiring refrigeration i.e. not segregated from the rest (which is desired-since it is a high alert drug). OT, as well as other products containing OT are listed on MDH's list of high alert drugs as shown in figure 3.2 below.

|            |                                                     |
|------------|-----------------------------------------------------|
| OXYTO-J174 | OXYTOCIN 10IU/ML INJECTION (HIGH ALERT) (HMP)       |
| OXYTO-J175 | OXYTOCIN + ERGOMETRINE INJECTION (HMP) (HIGH ALERT) |

Figure 3.2: OT on Hospital's High Alert Drug List

The label used for all infusion bags including OT, at MDH is shown below (Figure 3.3).

Disparities from the one shown in the toolkit (Figure 3.4) include the preset name of the drug (OT), the units of OT added to the bag, the final concentration of OT in mU/mL, the initials of the independent double checker of preparation. The suggested labelling in the toolkit is ideal for local implementation.

| THIS INFUSION CONTAINS AN ADDITIVE |     |                 |  |
|------------------------------------|-----|-----------------|--|
| PATIENT'S NAME _____               |     | FILE NO. _____  |  |
| WARD _____                         |     | ADDED BY _____  |  |
| ADDITIVE                           | QTY | BATCH           |  |
|                                    |     |                 |  |
| COMMENCED _____                    |     | DRIP RATE _____ |  |
| CONCLUDED _____                    |     | DATE _____      |  |

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**Figure 3.3: Local Infusion Bag Labelling**

PATIENT NAME: \_\_\_\_\_

Amount of drug added (mU): \_\_\_\_\_

Final CONCENTRATION (mU/ml): \_\_\_\_\_

**HIGH ALERT!** **Oxytocin**

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Administered by: \_\_\_\_\_

Checked by: \_\_\_\_\_

Figure 1: Label for reconstituted oxytocin IV bag

Concentration (mU/ml): \_\_\_\_\_

**HIGH ALERT!** **Oxytocin**

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Figure 2: Adult syringe label for oxytocin

**HIGH ALERT!** **Oxytocin** Concentration (mU/min): \_\_\_\_\_

**HIGH ALERT!** **Oxytocin** Date: \_\_\_\_\_ Time: \_\_\_\_\_

Figure 3: IV line label for oxytocin

**Figure 3.4: Suggested OT Labelling**

There are no standardised order sets for the OT induction and augmentation. There are no official double check algorithms. However, midwives claimed that they do double check with one other colleague that the drug that they took out from the fridge was indeed OT. Double checking seems to be limited to only this. There seems to be no formal ongoing training pertaining specifically to independent double checking.

The current local protocol followed has an initial rate of 6 mL/hr (2 mU/minute), doubling the rate every 15 minutes until regular contractions are achieved or up to a maximum rate of 96mL/hr (32 mU/minute). As defined in the toolkit, a low dose protocol is one starting at a rate of 1-2 mU/minute (3-6 mL/hr), increasing the dose by 1-2 mU/minute (3-6 mL/hr). Therefore, based on this the currently followed protocol employs the initial rate of a low-dose protocol, but fails to do so when it come to the incremental doses- which locally can be as high as 48 mL/hr (16 mU/minute) as opposed to what is listed in the toolkit- 1-2 mU/minute (3-6 mL/hr), and when it comes to the maximal infusion rate.

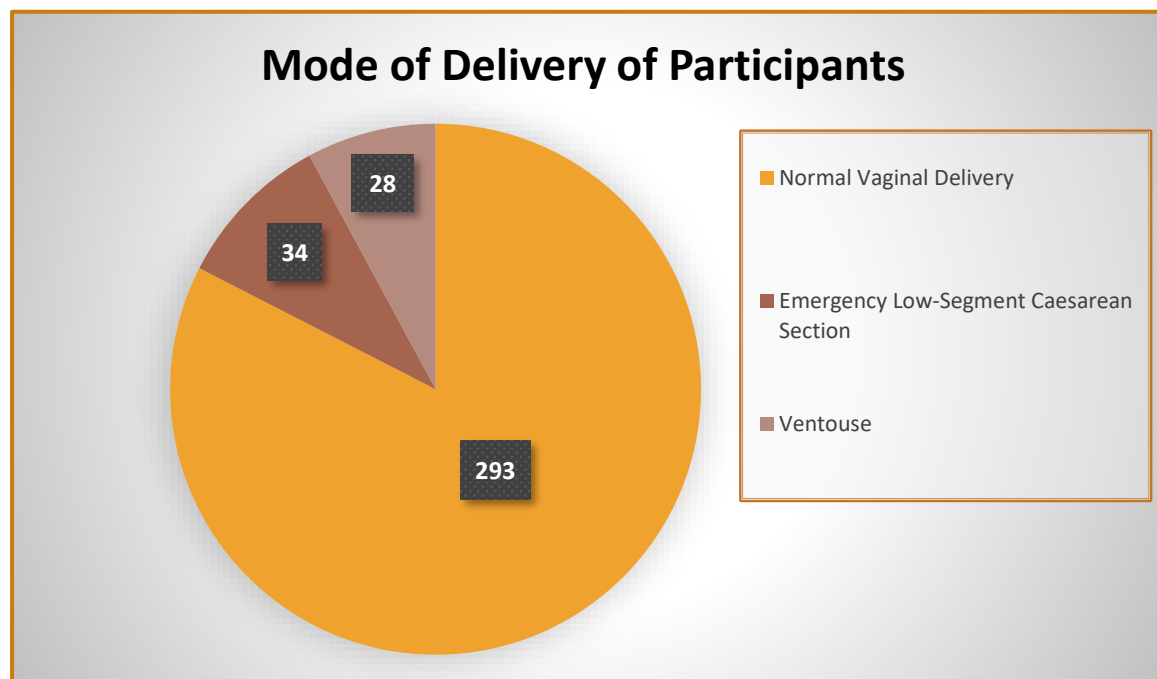
Appropriate HCPs are educated about when to stop, reduce or restart OT during the FHS sessions. The MRP does sometimes complete an in-person assessment prior to the initiation of OT infusion. Manier times, as claimed by the midwives, such an instruction to start SyntOT is usually given by the prescriber over the phone “start OT as per protocol”.

Mothers receiving SyntOT have a 1:1 midwife for continuous support and monitoring during labour. Some midwives stay at the patient’s bedside during infusion administration. Others stay for some time and then leave to return to the nurses’ station from where they can access the ongoing CTGs in all delivery rooms. They will go to patient’s bedside if CTG looks abnormal when viewing from nurses’ station and periodically to check on the mother.

### 3.4 Sample Characteristics

The inclusion criteria was met by 355 cases after reviewing 644 cases from the randomised sample list. The remaining cases met the exclusion criteria for several reasons. The mean maternal age lied in the 27-33 age group. The mean gestational age was that of 39.23 weeks and the average BMI for the participants whose such data was available was 25.2- which is classified as overweight. The average amount of OT units administered was 5.10 units and the mean duration of infusion was 5.60 hours. The average DOL was 6.04 hours.

The average AS at 1 and 5 minutes were 8.70 and 9.02 respectively. The mean baseline FHR was that of 139 bpm.



**Figure 3.5: Participants included in the study, N=355**

### 3.5 Statistical Analysis

#### 3.5.1 Patient Characteristics

In the first set of tests, the categorical variables are correlated using the Chi-Squared test as follows.

**Table 3.2: Nationality against OT use**

|             |             |       | Oxytocin Use       |                    |
|-------------|-------------|-------|--------------------|--------------------|
|             |             |       | Yes                | No                 |
| Nationality | Maltese     | Count | 149 (61.6%)        | 93 (38.4%)         |
|             | Non-Maltese | Count | 72 (63.7%)         | 41 (36.3%)         |
|             |             | Total | <b>221 (62.3%)</b> | <b>134 (37.7%)</b> |

$\chi^2(1) = 0.151$ ,  $p = 0.698$

31.5% of the participants were of foreign origin. The percentage of Non-Maltese mothers who made use of OT was slightly higher than the Maltese counterparts (63.7% vs 61.6%). However, this difference is not significant as the p value (0.698) is larger than the 0.05 criterion.

**Table 3.3: Parity against OT use**

|        |             |       | Oxytocin Use       |                    |
|--------|-------------|-------|--------------------|--------------------|
|        |             |       | Yes                | No                 |
| Parity | Nulliparous | Count | 147 (73.9%)        | 52 (26.1%)         |
|        | Multiparous | Count | 74 (47.4%)         | 82 (52.6%)         |
|        |             | Total | <b>221 (62.3%)</b> | <b>134 (37.7%)</b> |

$\chi^2(1) = 26.003$ ,  $p = 0.001$

73.9% of the participants who used OT were nulliparous. Only 47.4% of the 'Yes' group were multiparous.

These percentages vary significantly since the p-value (0.001) is less than the 0.05 level of significance.

Having a higher parity generally means that consequent labours will not be as difficult as the first-less LD. This could mean that multiparous women are less likely to be administered OT for IOL or AOL. Another reason could relate to the fact that the uterus of a multiparous mother is more susceptible to uterine rupture than that of a nulliparous mother. Hence, the use of OT in the multipara group is discouraged, which could contribute to such a significance (Cluver et al., 2010). Lukasse et al. (2020) reported a significantly higher number of primiparous women to use OT-60% vs 30.5%.

**Table 3.4: Maternal age against OT use**

|                             |            |              | Oxytocin Use       |                    |
|-----------------------------|------------|--------------|--------------------|--------------------|
|                             |            |              | Yes                | No                 |
| <b>Maternal age (years)</b> | 14-20      | Count        | 15 (60.0%)         | 10 (40.0%)         |
|                             | 21-26      | Count        | 16 (55.2%)         | 13 (44.8%)         |
|                             | 27-33      | Count        | 144 (65.2%)        | 77 (34.8)          |
|                             | 34-40      | Count        | 42 (57.5%)         | 31 (42.5%)         |
|                             | 41 or more | Count        | 4 (57.1%)          | 3 (42.9%)          |
|                             |            | <b>Total</b> | <b>221 (62.3%)</b> | <b>134 (37.7%)</b> |

$$\chi^2(4) = 2.236, p = 0.692$$

Around 62.3% of the participants claimed that they made use of oxytocin, while the remaining 37.7% didn't use this drug. However, these percentages vary marginally between the different maternity age groups since the p-value (0.692) exceeds the 0.05 level of significance.

Although in this study, there was no significant correlation between maternal age and OT use during labour, other studies suggest different correlations. Studies investigating the

relationship between higher maternal age and potential pregnancy complications have been on the rise, complimenting the fact that nowadays women are getting pregnant at a later age than before, possibly with more diseases or comorbidities. Increased labour dystocia (LD) in cases of advanced maternal age has been reported in several studies. A study by Waldenström et al. (2017) concluded that maternal age influences the difficulty of labour in the first, second and third births. In the event of LD, the likelihood to use OT to aid in the progress of parturition increases, which could explain the potential correlation between higher maternal age and more OT use (Brüggemann et al., 2024).

### 3.5.2 Analgesia Against OT use

**Table 3.5: Epidural use vs OT use**

|              |     |       | Oxytocin Use |             |
|--------------|-----|-------|--------------|-------------|
|              |     |       | Yes          | No          |
| Epidural use | Yes | Count | 116 (87.2%)  | 17 (12.8%)  |
|              | No  | Count | 109 (49.1%)  | 113 (50.9%) |
|              |     | Total | 225 (63.4%)  | 130 (37.2%) |

$\chi^2(1) = 48.641, p < 0.001$

There is a larger percentage of participants using OT who made use of EDA (87.2%) than participants who did not use EDA. This percentage difference is significant since the p-value (approx. 0) is smaller than the 0.05 level of significance. Hence, we can generalise that the use of epidural is more prevalent with OT use.

EDA has been shown to be significantly associated with OT use. This finding agrees with other published studies (Baranowska et al., 2021; Bączek et al., 2022). OT can lead to the increased use of EDA due to the stronger, more painful contractions brought about by

SyntOT. Contrariwise, EDA can lead to having to use more OT due to decreased sensation at the maternal end, yielding less effective contractions (Walter et al., 2021).

**Table 3.6: Pethidine use against OT use**

|               |     |       | Oxytocin Use       |                  |
|---------------|-----|-------|--------------------|------------------|
|               |     |       | Yes                | No               |
| Pethidine use | Yes | Count | 106 (66.25%)       | 54 (33.75%)      |
|               | No  | Count | 114 (58.5%)        | 81 (41.5%)       |
|               |     | Total | <b>220 (62.0%)</b> | <b>135 (38%)</b> |

$\chi^2(1) = 2.716, p = 0.099$

There is a larger percentage of participants using OT who made use of pethidine (66.25%) than participants who did not use pethidine. This percentage difference is not significant since the p-value (0.099) is larger than the 0.05 level of significance.

### 3.5.3 OT Outcomes on CTG, Mode of Delivery and NPICU admission

**Table 3.7: Decelerations against OT use**

|               |                                               |       | Oxytocin Use       |                    |
|---------------|-----------------------------------------------|-------|--------------------|--------------------|
|               |                                               |       | Yes                | No                 |
| Decelerations | No decelerations                              | Count | 145 (56.6%)        | 111 (43.4%)        |
|               | Early or variable with no concerning features | Count | 44 (77.2%)         | 13 (22.8%)         |
|               | Late or variable with concerning features     | Count | 35 (83.3%)         | 7 (16.7%)          |
|               |                                               | Total | <b>224 (63.1%)</b> | <b>131 (36.9%)</b> |

$\chi^2(2) = 16.168, p < 0.001$

There is a larger percentage of participants using OT who experienced a late or variable deceleration with concerning features (83.3%) than participants with no decelerations. This percentage difference is significant since the p-value (approx. 0) is smaller than the 0.05 level of

significance. Hence, we can generalise that late or variable decelerations are more prevalent with the use of oxytocin.

This study showed a significant association between OT use and late or variable decelerations with concerning features (83.3%). Drops in FHR occur in hypoxic instances, which instances are more common with OT use due to stronger, more frequent contractions. Cord compression and reduction in blood supply to the placenta at the height of a contraction mean less oxygenation to the foetus. This increased hypoxia is reflected in deeper and longer decelerations (Gibb, 2023).

**Table 3.8: Beat to Beat Variation against OT use**

|                               |                               |              | Oxytocin Use       |                    |
|-------------------------------|-------------------------------|--------------|--------------------|--------------------|
|                               |                               |              | Yes                | No                 |
| <b>Beat to Beat variation</b> | Less than 5 bpm (amber)       | Count        | 135 (59.0%)        | 94 (41.0%)         |
|                               | Decreased Variability (amber) | Count        | 26 (76.5%)         | 8 (23.5%)          |
|                               | 5-25bpm (white)               | Count        | 63 (68.5%)         | 29 (31.5%)         |
|                               |                               | <b>Total</b> | <b>224 (63.1%)</b> | <b>131 (36.9%)</b> |

$\chi^2(2) = 4.780, p = 0.092$

A larger percentage of participants who used OT experienced decreased variability (76.5%) or a variability of less than 5bpm (59.0%) than mothers who were not administered OT. However, this percentage difference is not significant since the p-value (0.092) is larger than the 0.05 level of significance.

**Table 3.9: Mode of Delivery against OT use**

|                                 |                         |              | Oxytocin Use       |                    |
|---------------------------------|-------------------------|--------------|--------------------|--------------------|
|                                 |                         |              | Yes                | No                 |
| <b>Mode of Present Delivery</b> | Normal Vaginal Delivery | Count        | 176 (60.1%)        | 117 (39.9%)        |
|                                 | Emergency LSCS          | Count        | 25 (73.5%)         | 9 (26.5%)          |
|                                 | Ventouse                | Count        | 20 (71.4%)         | 8 (28.6%)          |
|                                 |                         | <b>Total</b> | <b>221 (62.3%)</b> | <b>134 (37.7%)</b> |

$\chi^2(2) = 3.438, p = 0.179$

There is a larger percentage of participants who delivered their child via LSCS following OT use (73.5%) than participants who gave birth through normal vaginal delivery (60.1%) or ventouse delivery (71.4%) following OT use. This percentage difference is not significant since the p-value (0.179) is larger than the 0.05 level of significance.

Although OT use increases the risk of instrumental deliveries and Em/LSCS, this was reported as not significant in this study. Other studies report contrasting findings. Oscarsson et al. (2006) and a recent, 2020 Pakistani study showed a positive association between OT use and Em/LSCS. This was particularly true for nulliparous women who were induced with OT (Lukasse et al., 2020). Oscarsson and colleagues also reported a positive correlation between OT use and instrumental deliveries.

**Table 3.10: NPICU admission against OT use**

|                 |     |       | Oxytocin Use       |                    |
|-----------------|-----|-------|--------------------|--------------------|
|                 |     |       | Yes                | No                 |
| NPICU Admission | Yes | Count | 0 (0.0%)           | 1 (100.0%)         |
|                 | No  | Count | 219 (61.9%)        | 135 (38.1%)        |
|                 |     | Total | <b>219 (61.7%)</b> | <b>136 (38.3%)</b> |

$$\chi^2(1) = 1.639, p = 0.200$$

The p-value is more than 0.05. Hence this result is not significant. OT use has been linked to the increased likelihood of neonatal intensive care (Oscarsson et al., 2006). Reasons for NPICU admission may include less gas exchange across the placenta because of hyperstimulation.

The next set of tests involves one categorical variable and one continuous variable. First, the Shapiro Wilk test was run to determine the normality of the variable, which will in turn determine the test to be run i.e. either independent samples t-test (for normal distributions) or the Mann Whitney Test (for skewed distributions).

**Table 3.11: Shapiro Wilk Test**

|                                   | Shapiro-Wilk |     |         |
|-----------------------------------|--------------|-----|---------|
|                                   | Statistic    | df  | P-value |
| <b>Gestational age</b>            | 0.964        | 147 | <0.001  |
| <b>Body Mass Index (BMI)</b>      | 0.932        | 147 | <0.001  |
| <b>Duration of labour (hours)</b> | 0.939        | 147 | <0.001  |
| <b>Apgar Score 1 minute</b>       | 0.283        | 147 | <0.001  |
| <b>Apgar Score 5 minutes</b>      | 0.320        | 147 | <0.001  |
| <b>Baseline Foetal Heart Rate</b> | 0.988        | 147 | 0.252   |
| <b>Frequency of contractions</b>  | 0.889        | 147 | <0.001  |

After running the Shapiro Wilk test, Table 3.11 above was generated, which shows that the baseline FHR distribution satisfies the normality assumption since the p-value (0.252) exceeds the 0.05 level of significance. However, the remaining score distributions violate the normality assumption since the p-values (approx. 0) are smaller than the 0.05 criterion.

Results from this study have shown that as the gestational age increases, so does the OT use, which is what was expected. The mean gestational age for all the sample (including AOL and IOL) was 39.37 weeks. This agrees with theory as AOL and IOL occur at term unless there are other clinical indications to start labour before term. The highest number of contractions recorded was 7 contractions in 10 minutes. This nulliparous mother had been administered 2.5 units of OT over 3.88 hours.

The DOL has been shown to be significantly longer when OT was used. There are two sides to this correlation. On one side, (theoretically) for a woman to be started on OT she must be progressing at a slower pace than normal, automatically resulting in a longer DOL. Another possibility is that

labour is prolonged due to the SyntOT infusion itself, especially when this is administered for longer times at higher concentrations, which causes OTR desensitisation and inefficient response of the uterine muscles to OT. Espada-Trespalcacios (2021) corroborated this statistically significant prolongation of labour, specifically in the second stage, by 18 minutes, contrasting with findings by Boie et al. (2021) who reported no associations between OT use and the second stage of labour. In this study, labour was not divided into its different stages, so a more accurate correlation would include the separate stages of parturition rather than the whole process.

The frequency of contractions reflects the mode of action of this hormone. For this study, the frequency of contractions was measured when the concentration of the OT infusion was at its highest for that mother to better analyse the influence of OT on the uterus.

The AS at 1 minute was borderline to being statistically significant- but it is not. It was 0.14 units higher in cases where OT was not used. The AS at 5 minutes varied only by 0.3 units. This could be explained by the fact that if for some reason the AS at 1 minute is low, then measures are immediately taken to improve the situation, which improvement would then be reflected in the AS at 5 minutes. Literature is conflicting. Findings from this study agree with those by Hidalgo-Lopezosa et al. (2016). Contrastingly, Farag et al. (2020) reported no significant association between OT use for AOL and both AS. Bączek et al. (2022) found a significant association between AOL with OT and a 1 minute AS less than 7 whereas a 2020 Nepali study reported a less than 7 AS at 5 minutes (Litorp et al., 2020).

The Independent samples t-test and the Mann Whitney test are used to compare mean scores between two independent groups (used oxytocin, did not oxytocin). The former test is used when the score distribution is normal, while the latter test is used when the score distribution is skewed.

**Table 3.12: Independent Samples T-test and Mann Whitney Tests**

|                            | Oxytocin Use | N   | Mean   | Std. Deviation | P-value |
|----------------------------|--------------|-----|--------|----------------|---------|
| Gestational age            | Yes          | 221 | 39.37  | 1.556          | <0.001  |
|                            | No           | 134 | 38.99  | 1.211          |         |
| Body Mass Index (BMI)      | Yes          | 98  | 25.66  | 5.712          | 0.359   |
|                            | No           | 68  | 24.48  | 4.365          |         |
| Duration of labour (hours) | Yes          | 193 | 6.44   | 3.600          | 0.003   |
|                            | No           | 124 | 5.25   | 3.096          |         |
| Apgar Score 1 minute       | Yes          | 221 | 8.65   | 0.910          | 0.096   |
|                            | No           | 134 | 8.79   | 0.716          |         |
| Apgar Score 5 minutes      | Yes          | 221 | 9.03   | 0.315          | 0.642   |
|                            | No           | 134 | 9.00   | 0.407          |         |
| Baseline Foetal Heart Rate | Yes          | 220 | 138.87 | 10.156         | 0.795   |
|                            | No           | 128 | 139.17 | 11.148         |         |
| Frequency of contractions  | Yes          | 218 | 4.38   | 0.868          | <0.001  |
|                            | No           | 126 | 3.82   | 0.898          |         |

In cases where the p-value is less than 0.05, the mean scores vary significantly - this applies for gestational age ( $p < 0.001$ ), DOL ( $p = 0.003$ ) and frequency of contractions ( $p < 0.001$ ). BMI, AS at 1 and 5 minutes as well as the baseline foetal heart rate, which means between the two OT groups varied only marginally.

**Table 3.13: Spearman Correlations**

|                |                               |                         | Body Mass Index (BMI) | Duration of labour (hours) | Frequency of contractions |
|----------------|-------------------------------|-------------------------|-----------------------|----------------------------|---------------------------|
| Spearman's rho | Amount of Oxytocin units used | Correlation Coefficient | -0.027                | 0.048                      | -0.011                    |
|                |                               | P- value                | 0.795                 | 0.510                      | 0.873                     |

Although there were more mothers with a higher BMI who were administered OT, this difference was not found to be statistically significant. A large multicenter study which took place in the USA in 2011 reported significant slower progress for the first stage of labour in women with a higher

BMI irrespective of parity, which complements the higher use of OT in higher BMI cases. Time taken to progress from 4 cm to 10 cm was reported to be 5.4 hours for nullipara with BMI < 25 kg/m<sup>2</sup> and 7.7 hours for nullipara with BMI ≥ 40 kg/m<sup>2</sup> (Kominiarek et al., 2011). For multipara, this was reported to be 4.6 hours and 5.4 hours respectively. Such a correlation, along with prolonged labour and higher LCSC rates in higher BMI is also reported by Hehir and Morrison (2012).

**Table 3.14: Kruskal Wallis Test**

|                       | N   | Mean amount of OT units used | Std. Deviation | p-value |
|-----------------------|-----|------------------------------|----------------|---------|
| Normal                | 133 | 5.6619                       | 12.08686       | 0.620   |
| Decreased Variability | 21  | 4.2494                       | 6.33041        |         |
| More than 5 bpm       | 57  | 4.1516                       | 4.87646        |         |

The Kruskal Wallis test was used to compare mean amount of oxytocin used between three or more independent groups of participants clustered by their beat-to-beat variation.

## 4. DISCUSSION

In this last chapter, results obtained from the different parts of this study will be discussed. The limitations of the study as well as recommendations for future research and for local improvement of clinical practice will be gone over. The significance of having a specialised Pharmacist on obstetrics wards, including the delivery suite will be highlighted. The conclusions of the research will be expressed at the end.

#### 4.1 Increased Patient Safety

This study has created more awareness and understanding on this high-alert uterotonic drug. The significance of the gaps identified relates to measures proposed to increase patient safety, at both maternal and foetal ends. Such measures include pre- and in-use checklists, improved OT infusion labelling and independent double-checking procedures. The retrospective fieldwork carried out has confirmed some of the relationships between OT and other factors investigated, which were also reported by other authors.

The rate of SyntOT was indeed decreased or stopped altogether in the event of too many contractions or any other foetal concerns and restarted later when CTG returned to normal. However, it was noted that the infusion was in general doubled sooner than after 15 minutes, as described in the protocol. There seemed to be no clinical justifications for such an increase. Deviation in use from the SmPC of Syntocinon<sup>®</sup> itself raises more concern, wherever it happens. The license of the product states that 5 units of OT are to be mixed with 500 mL of electrolyte solution. The 10 units in 500 mL combination is advised in cases of IOL earlier in pregnancy or in cases of IUD, neither of which apply in this study because IUD cases were excluded from the study and the average gestational age of the sample was 39.18 weeks. This stresses further the lack of standardisation of OT. More studies and global efforts are required to move towards optimising OT usage during labour.

Another point worth discussing and reflecting on is the rate of the IOL. As explained clearly in literature, the rate of IOL has increased. There was a total of 99 IOL cases in the study, of which the mean gestational age was 39.88 weeks. Sixty-six cases of these had at least 40 weeks gestation and the reason for IOL was documented as “post- dates”. Four of these were induced at 41 weeks i.e. 4.04% of the whole IOL group. While some of the cases being induced earlier had a clear reason why this was performed, for example decreased foetal movement, SROM, regular contractions and macrosomia, the reason for IOL was unclear in others. The NICE recommends that IOL should be performed at 41 weeks. Although with low-certainty evidence, the WHO also recommends IOL women in whom the 41 weeks mark have been reached (41 weeks +0/7 days)<sup>12</sup>, and similarly, WHO does not recommend IOL in women with uncomplicated pregnancy prior to completing 41 weeks of gestation. Efforts should be made to address the increasing rates of IOL, to protect mother and foetus from any potential negative outcomes. In an attempt to limit variation in IOL practices, a toolkit by the CMNRP<sup>13</sup> (Appendix 5) was developed, which together with the PCMCH toolkit, which was used in this study aim to standardise OT practice. The IOL request form, the cervical ripening flowchart, the IOL audit tool, the IOL patient education tool, the outpatient cervical ripening patient information sheet, the telephone assessment for outpatient cervical ripening for health care providers, the misoprostol policy for cervical ripening and IOL and the outpatient cervical ripening policy and procedure make up this toolkit.

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<sup>12</sup> WHO. WHO recommendations on induction of labour, at or beyond term [Internet]. Geneva: WHO.; 2022 [cited 21 May 2024]. Available from: <https://iris.who.int/bitstream/handle/10665/363138/9789240052796-eng.pdf?sequence=1>

<sup>13</sup> Champlain Maternal Newborn Regional Program. Introduction Package Induction of Labour Toolkit. Ottawa.2021 [cited 10 June 2024]. Available from: [http://www.cmnrp.ca/uploads/documents//Complete\\_Toolkit\\_August\\_2021.pdf](http://www.cmnrp.ca/uploads/documents//Complete_Toolkit_August_2021.pdf)

Starting labour in a timely manner will reduce interventions, over-medicalised physiological processes, ultimately leading to an overall more positive birth experience for all those involved.<sup>14</sup> OT is the most widely used drug for IOL (Sanchez et al., 2023). A study by Caruana et.al (2016), shows that there is a high rate of IOL at Mater Dei Hospital (MDH). In this study, IOL was performed before completing 40 weeks of gestation in 42.7% of the mothers. This raises concerns in relation to the WHO recommendations mentioned above (Rashidi et. al., 2022). A dramatic increase in the rates of IOL is also reflected globally. In the United States, rates have gone up<sup>15</sup> from 9.5% in 1991 to 27.1% in 2018 (Rashidi et. al., 2022) and to around 28% in Malta (Gauci and Spiteri, 2022). Since OT is the most widely used drug for IOL globally, these rates mean that the use of OT during labour inevitably increases. In the local OT evaluation part of this study, the average gestational age of the whole sample was 39 weeks so the WHO recommendation regarding IOL could have been more adhered to. Higher OT doses and therefore more units of OT are required for IOL than for augmentation of labour (AOL) since there are less OTR in the uterus where labour has not yet begun naturally. Controlling induction rates better and more justified OT use, will automatically mean better OT use.

Optimising practice by adhering to the WHO recommendations pertaining to the IOL recommendation after completing 41 weeks of gestation is one way forward to enhance patient safety. IOL increases the likelihood of having to perform EM/LSCS. Such procedures do not come without risks to either the mother nor the baby at birth and beyond. PPH, wound infections, endometritis, thromboembolism, and anesthetic effects are amongst the

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<sup>14</sup>WHO. WHO recommendations on induction of labour, at or beyond term [Internet]. Geneva: WHO.; 2022 [cited 21 May 2024]. Available from: <https://iris.who.int/bitstream/handle/10665/363138/9789240052796-eng.pdf?sequence=1>

<sup>15</sup> IHI. How-to-Guide: Prevent Obstetrical Adverse Events.2012. [cited 5 May 2024]. <https://perigen.com/wp-content/uploads/2016/08/HowtoGuidePreventObstetricalAdverseEvents.pdf>

common maternal complications following LSCS, the incidence of which is relatively significant. There is roughly 1% risk of having foetal trauma during LSCS, which could be manifested as skin laceration, clavicle-or skull fracture, facial or brachial plexus nerve damage, cephalohematoma, risk of respiratory complications, asthma and allergy. Having had a LSCS poses the mother at a higher risk to have future deliveries via LSCS, which can prove more complex in view of adhesion formation. The risk of placenta accreta following one LSCS stands at 0.3%, which increases to 6.74% with 5 or more deliveries. Consequently, LSCS and instrumental deliveries give rise to lengthier hospital stays and higher associated costs. Keeping in mind the increased risk of having to go for LSCS and instrumental deliveries following labour induction with OT, one must make very cautious and considerate decisions about inducing labour in the first place even more so when initiating parturition with OT to avoid preventable, unnecessary negative outcomes throughout the whole process. Labour is a complex process whereby an orchestration of events interplay to bring about the birth of the child (Sung and Manhdy, 2023).

## 4.2 Inter-and Intra-Professional Variations

OT is to be prescribed by an obstetrician. Very often disagreements are confronted between different HCPs regarding OT use namely between the physician, who is not present at patient's bedside and the practice nurse or midwife who is present at bedside. Often, the experienced nurse at bedside is correct. Pre-established, standardised criteria on the initiation, administration and monitoring agreed upon by both physician and practice nurses and/or midwives beforehand can be instrumental in eliminating such disagreements, while more importantly safeguarding patient safety. The algorithm in the PCMCH toolkit-

‘Disagreeing with the plan of care’ (Appendix 4) gives guidance for such situations. Applying AI models could prove instrumental in mitigating such variations or biases.

Since its introduction in the 1960s, CTG has been visually interpreted by midwives and obstetricians against pre-established guidelines to ensure satisfactory foetal well-being. The first CTG guideline was published by the ACOG in 1974. However, the benefits of continuous CTG over simpler foetal monitoring methods like intermittent auscultation are still argued. One of the reasons for this is the great variation in CTG interpretation. One way to mitigate this intra- and interobserver variation is by incorporating computer-aided systems in the CTG apparatus for automatic detection of foetal hypoxia (M'Barek et al., 2023).

#### 4.3 Artificial Intelligence in Patient Safety Improvement

The application of AI in the medical field is becoming more popular in view of machines with learning and problem-solving capabilities. Implementing AI models for CTG interpretation could prove to be instrumental in improving care in the intrapartum period to both mother and baby through more timely and more accurate, unbiased CTG interpretation. Since introducing CTG in obstetrics, instrumental deliveries and LSCS rates have increased, which stimulates debates pertaining to CTG use in the first place. Prediction of foetal hypoxia by means of AI could aid in better clinical decision making. Applying AI could optimise the rates of such unnecessary medical interventions, which not only benefit the parturient and the offspring, but also improve economic aspects. AI could also thwart suboptimal interpretation by the HCP due to exhaustion following long hours of work or less time due to increased workload. Although they have demonstrated equal efficiency when compared to human interpretation, none of the numerous existing commercial systems have been largely accepted or widely used. At time of writing a prominent AI system for CTG interpretation,

SisPorto 2.0, a tool by Ayres de Campos and colleagues was identified (Aeberhard et al., 2024).

An extensive literature review of studies that investigate AI-based CTG interpretations including commercially available and not yet available systems, carried out by Aeberhard and her team in 2023 concluded that literature is still scarce. Not all AI systems are based on the same guidelines- there is no gold standard for CTG interpretation yet. This means that the systems would be trained differently. They also concluded that the potential benefit of reduced user variability has not yet been demonstrated.

Aeberhard and colleagues (2024), whose project is still ongoing worked together in Bern to create the most exhaustive and the second largest (following the database created in the INFANT study at Oxford University) CTG and foetal outcome database to be used for CTG AI systems programming. The final database produced by this research team will be tested in a future randomised controlled trial.

This CTG variability concern is intensified in relation to OT, because IV OT requires continuous CTG monitoring. Taking this into consideration, it is even more important to justify OT use to avoid the unnecessary use of OT and the consequent use of CTG, which could in turn lead to misinterpretations, carrying out unnecessary medical interventions, ultimately compromising patient safety.

## 4.4 Practice Recommendations

Nowadays, women are conceiving at a more mature age than before. The involvement of pharmacists in obstetrics needs to become more pronounced especially when considering that at present women are starting their pregnancy journey with more chronic diseases than ever before such as cardiovascular diseases or renal problems, partially giving rise to more complications (Gnadt, 2020; Small, 2023). In fact, Covvey and colleagues (2015) stated that 80% of women take at least one prescription medicine while pregnant. Small (2023) reported that parturients in 2020 had a higher mortality risk than their own mothers. In line with recommendations by the American College of Clinical Pharmacy having a specialised Pharmacist on obstetric wards is likely to safeguard the safety of both the mother and offspring.<sup>16</sup> Some of the services which could be performed by the specialised Pharmacist are listed in Appendix 8.

Regularly used drugs during pregnancy and labour are listed on the ISMP high-alert drug list. A study carried out in 2009, analysed 2,442 predominant medication error event types associated with the labor and delivery unit which occurred between June 2004 to April 2009. Results demonstrated that high-alert medications were involved in 46.4 % of wrong time/overdosage errors and in 55.2% of wrong-rate errors.<sup>17</sup> Another reason which justifies the involvement of a specialised Pharmacist in obstetrics is shown in a 2019 study which reported that one fourth of women with child-bearing potential were still prescribed drugs

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<sup>16</sup> American College of Clinical Pharmacy. Standards of Practice for Clinical Pharmacists. Pharmacotherapy 2014; 34(8):794–797. [cited 5 May 2024]. Available from: [http://www.accp.com/docs/positions/guidelines/StndrsPracClinPharm\\_Pharmaco8-14.pdf](http://www.accp.com/docs/positions/guidelines/StndrsPracClinPharm_Pharmaco8-14.pdf).

<sup>17</sup> Pennsylvania Patient Safety Authority. Pennsylvania Patient Safety Authority 2009 Annual Report. Pennsylvania 2009. [cited 5 May 2024]. Available from: [https://patientsafety.pa.gov/PatientSafetyAuthority/Documents/annual\\_report\\_2009.pdf](https://patientsafety.pa.gov/PatientSafetyAuthority/Documents/annual_report_2009.pdf)

that pose risks to the unborn child. The implementation of Pharmacist clinical reviews of antibiotic use in obstetrics led to significant reductions in their use along with a reduction in the mean hospitalization cost and in prophylaxis duration (Small, 2023).

Gnadt (2020) lists pharmacist interventions mainly ongoing prospective pharmacy profile reviews for expecting mothers who are classified as high-risk obstetric patients allowing for any appropriate treatment adjustments. Other interventions are listed in figure g below. A triage tool (Appendix 7) for obstetrics developed by Covvey and his team (2015) determined the effective identification of higher-risk patients who will benefit greatly from a pharmacist review. Specifically, the case will be classified as either green criteria or as red criteria, making it easier to prioritise Pharmacist review. Having a specialised Pharmacist on the ward further contributes to the interdisciplinary efforts in obstetrics.

SyntOT for AOL and IOL is not a substitute for the physiological hormonal deficit (Thornton et al., 1993). For example, in one IOL case carried out at 40+1 weeks for a low-risk pregnancy in view of term gestation in a nulliparous woman, that was analysed in the retrospective fieldwork in this project, 129.32 OT units were administered over 15 hours, which ended up in a normal vaginal delivery, after using EDA. Considering that there were no other concerning clinical justifications for IOL, one might start reflecting more on questions such as: could the mother have been allowed to progress naturally longer, before inducing? Could the high amount of OT units used have been avoided?

## 4.4 Limitations

Practice was only investigated at MDH the main acute hospital in Malta. Other hospitals might have different clinical practices. Only English Language studies were consulted.

Valuable literature in other languages might be available.

Although the sample size used was not small, a larger one would allow for more result robustness. The DOL in this study was considered as the first and second stage together. Splitting the two will enable the researcher to analyse the influence of OT on either stage better.

Although this study was built on background research on CTG and consulted a number of obstetricians how CTG works, it was decided to record CTG interpretation including frequency of contractions, beat to beat variability and baseline FHR from patient's notes, which were readily documented by other HCPs. This was done to reduce the magnitude of the limitation that the researcher might have misinterpreted the partogram.

## 4.5 Recommendations for Further Studies

Blood sample evaluation and the mother's hydration status in relation to OT are areas which could be explored. Investigating such a topic among special populations including diabetic and hypertensive mothers could prove beneficial in handling such patients. The effect of OT on CTG during the different stages of labour is an important area for investigation. AI employment in CTG interpretation certainly requires more thorough investigation.

## 4.6 Conclusion

The life-saving capacity of OT cannot be underestimated, but so cannot its significant potential of negative outcomes. Hence, this high-alert drug must be used judiciously when

medically necessary. The Best Practice Implementation Strategy proposed in this study adds on to the existing good practices by focusing on pre and in-use checklists as well as improved labelling and independent double-checking procedures, safeguarding patient safety and decreasing variability between HCPs through a more structured, systematic arrangement.

Further research is still required to determine the optimal, systematic elements such as concentration, dose and rate of OT infusion during labour. Adhering to such standards should be the common goal of all stakeholders involved in the picture.

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## APPENDICES

## Appendix 1: Ethics Approval



**L-Università  
ta' Malta**

**Faculty of  
Medicine & Surgery**

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Ref No: MED-2023-00197

5 July 2023

Ms Rebecca Marie Falzon  
36, Erfolg,  
Triq il-Kappar  
Attard ATD2282

With reference to your application submitted to the Faculty Research Ethics Committee in connection with your research entitled:

Best Practice Implementation Strategy In The Use Of Oxytocin During Labour

The Faculty Research Ethics Committee is granting ethical approval for the above-mentioned application.

A handwritten signature in black ink, appearing to read 'Anthony Serracino Inglott'.

Professor Anthony Serracino Inglott  
Chair  
Faculty Research Ethics Committee

## Appendix 2: Google Form used for Data Collection

### Best Practice Implementation Strategy for the Use of Oxytocin During Labour -Data Collection Tool

#### Nationality

- ☐ Maltese
- ☐ Non-Maltese

#### Maternal Age \*

- ☐ 14-20
- ☐ 21-26
- ☐ 27-33
- ☐ 34-40
- ☐ 41-46
- ☐ 46+

#### Parity \*

- ☐ Nulliparous
- ☐ Multiparous

#### Gravida \*

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ more than 5

**Gestational age (weeks) \***

**Body Mass Index (Mass/ (H)^2**

**Gravida Para \***

**Previous Mode of Delivery \***

- ☐ Normal Vaginal Delivery
- ☐ Emergency LSCS
- ☐ Vaginal Birth After Cesarean
- ☐ Ventouse Delivery
- ☐ Forceps
- ☐ KIWI
- ☐ Not applicable

**Oxytocin Use**

- ☐ Yes
- ☐ No

**Oxytocin Indication**

- ☐ Induction
- ☐ Augmentation

**Reason for induction or augmentation**

**Amount of Oxytocin Units used (units)**

**Duration of infusion (hours)**

**Duration of Labor (hours)**

**Mode of present delivery \***

- ☐ Normal Vaginal Delivery
- ☐ Emergency LSCS
- ☐ Vaginal Birth after Cesarean
- ☐ Ventouse Delivery
- ☐ Forceps
- ☐ KIWI

**Apgar Scores 1 minute \***

**Apgar Scores 5 minutes \***

**Baseline Foetal Heart Rate (bpm)****Was there a change in baseline Foetal Heart Rate over time? - In the first and last 10 minutes of CTG****Beat to beat variation (bpm)**

- ☐ Normal- Less than 5 bpm
- ☐ More than 25 bpm
- ☐ Decreased variability
- ☐ more than 5 bpm
- ☐ No data available

**Accelerations**

- ☐ Yes
- ☐ No
- ☐ No data available

**Decelerations**

- ☐ Early or Variable with non concerning features
- ☐ Variable with concerning features or late decelerations
- ☐ No decelerations
- ☐ No data available

**Frequency of Contractions ( number of contractions per 10 minutes)****NPICU admission**

- ☐ Yes
- ☐ No

**Pethidine Use****Epidural Use****Comments**

## Appendix 3: Gap Analysis Tool



### Safe Administration of Oxytocin Gap Analysis Tool

| RECOMMENDATIONS                                                                                                                                                                                                                              | CURRENT STATE |               |       | ACTION (FUTURE STATE)                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|-------|------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                              | Met           | Partially Met | Unmet | What tools and strategies does your organization need to implement to meet this recommendation |
| Recommendation #1: Shared Decision Making                                                                                                                                                                                                    |               |               |       |                                                                                                |
| Patients are provided with information to participate in shared decision-making on oxytocin induction, augmentation, and expectant management.                                                                                               |               |               |       |                                                                                                |
| A patient-oriented fact sheet or pamphlet to summarize oxytocin use is provided to every patient being considered to start on oxytocin.                                                                                                      |               |               | _____ |                                                                                                |
| Informed consent for starting oxytocin is obtained and documented by MRP upon admission and again prior to medication set-up                                                                                                                 |               | _____         |       |                                                                                                |
| Informed consent discussion includes, but is not limited to: <ul style="list-style-type: none"><li>maternal and fetal indications</li><li>benefits and risks of oxytocin administration</li><li>benefits and risks of alternatives</li></ul> |               | _____         |       |                                                                                                |
| Recommendation #2: Inter-Professional Team Communication                                                                                                                                                                                     |               |               |       |                                                                                                |
| Members of the health care team must maintain communication that is clear, direct, and respectful.                                                                                                                                           |               |               |       |                                                                                                |
| The hospital/unit has an escalation process, or chain of command protocol, in place.                                                                                                                                                         | _____         |               |       |                                                                                                |
| The hospital/unit has a standardized transfer of accountability/handover process.                                                                                                                                                            | _____         |               |       |                                                                                                |
| Ongoing inter-professional team training and skills drills are provided and supported by clinical leadership.                                                                                                                                | _____         |               |       |                                                                                                |
| Recommendation #3: Indications for Induction or Augmentation                                                                                                                                                                                 |               |               |       |                                                                                                |
| The prescriber will order oxytocin for induction and/or augmentation for the appropriate indication(s).                                                                                                                                      |               |               |       |                                                                                                |
| Clinical decision-making tools about disagreeing with the plan of care as well as medication administration are used consistently, as required.                                                                                              |               |               | _____ |                                                                                                |
| Safety tools, such as checklists to ensure oxytocin is being used safely and for appropriate indications, are used consistently.                                                                                                             |               |               | _____ |                                                                                                |
| The cervix is assessed using the Bishop score to ensure that the pregnant patient has a favourable cervix ready for oxytocin administration.                                                                                                 |               | _____         |       |                                                                                                |
| Recommendation #4: Professional Skills Training                                                                                                                                                                                              |               |               |       |                                                                                                |
| Oxytocin is prescribed and administered by a trained health care professional educated on its use, including the effects and risks of drug administration.                                                                                   |               |               |       |                                                                                                |
| Initial and ongoing (every two years) inter-professional FHS training for all health care providers who are involved in intrapartum fetal monitoring is provided and supported.                                                              | _____         |               |       |                                                                                                |

## Safe Administration of Oxytocin Gap Analysis Tool

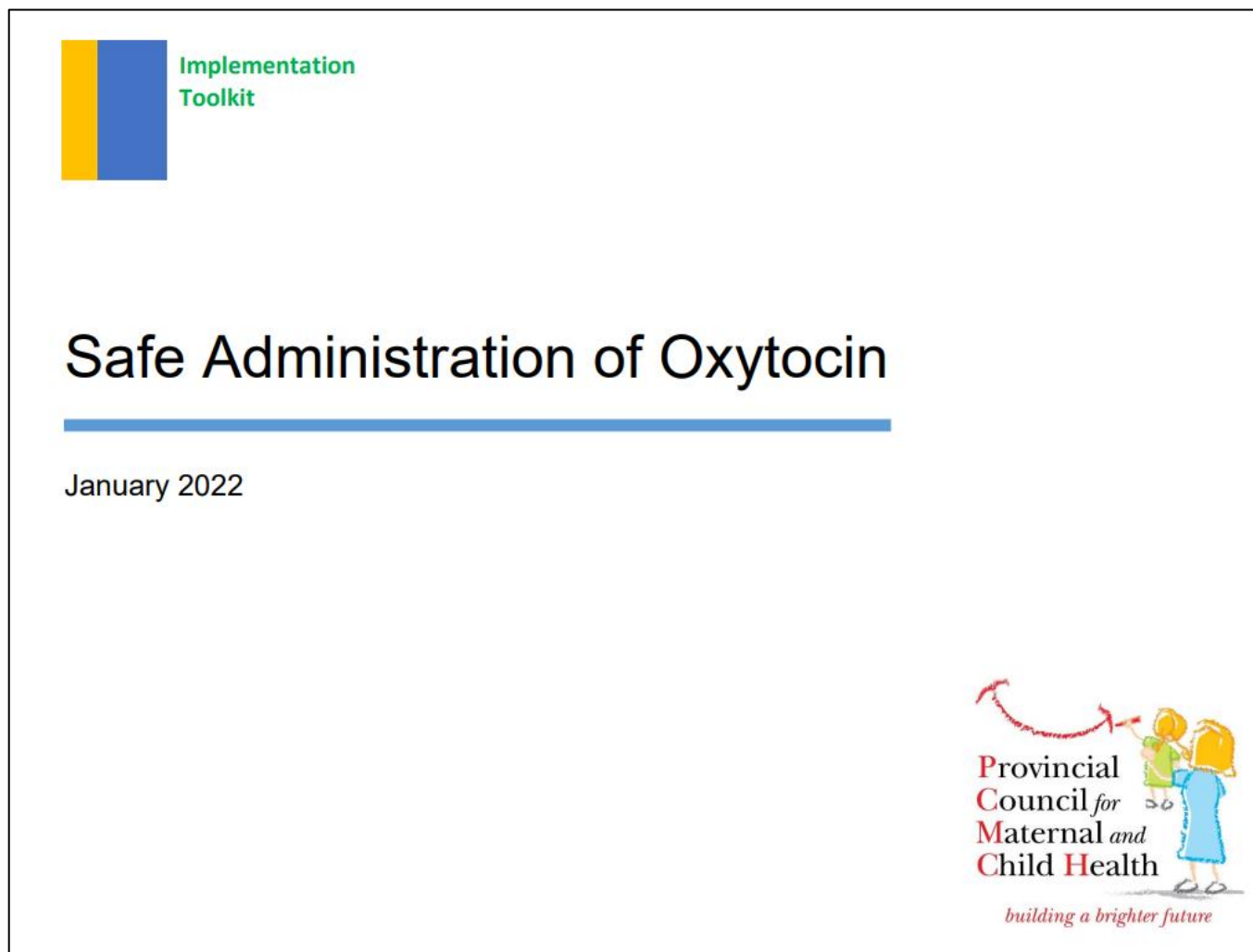


| RECOMMENDATIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CURRENT STATE |               |       | ACTION (FUTURE STATE)<br><i>What tools and strategies does your organization need to implement to meet this recommendation?</i> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|-------|---------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Met           | Partially Met | Unmet |                                                                                                                                 |
| Accessible drug information which lists onset, duration of action, administration guardrails and possible adverse effects of oxytocin administration is available for all staff.                                                                                                                                                                                                                                                                                           | —             |               |       |                                                                                                                                 |
| Training on the correct use of IV Smart Pumps is provided and supported for all staff.                                                                                                                                                                                                                                                                                                                                                                                     | —             |               |       |                                                                                                                                 |
| <b>Recommendation #5: Hospital Preparedness for Adverse Events</b>                                                                                                                                                                                                                                                                                                                                                                                                         |               |               |       |                                                                                                                                 |
| <i>Administration of oxytocin will occur in hospitals where interventions are readily available to manage potential adverse events.</i>                                                                                                                                                                                                                                                                                                                                    |               |               |       |                                                                                                                                 |
| The hospital is designated at an appropriate level of care and/or has timely access to the necessary resources to provide induction of labour.                                                                                                                                                                                                                                                                                                                             | —             |               |       |                                                                                                                                 |
| The hospital has policies and protocols in place to manage potential adverse events related to administration of IV oxytocin.                                                                                                                                                                                                                                                                                                                                              |               | —             |       |                                                                                                                                 |
| <b>Recommendation #6: Medication Handling</b>                                                                                                                                                                                                                                                                                                                                                                                                                              |               |               |       |                                                                                                                                 |
| <i>Oxytocin is stored safely and labelled appropriately.</i>                                                                                                                                                                                                                                                                                                                                                                                                               |               |               |       |                                                                                                                                 |
| Oxytocin is dispensed via a medication dispensing machine or a locked medication cart.                                                                                                                                                                                                                                                                                                                                                                                     |               |               | —     |                                                                                                                                 |
| Oxytocin is listed on the hospital's "High Alert Medication List"                                                                                                                                                                                                                                                                                                                                                                                                          | —             |               |       |                                                                                                                                 |
| Standardized medication label for oxytocin is utilized, that includes the following: <ul style="list-style-type: none"> <li>Name of drug</li> <li>Units of oxytocin added to the bag</li> <li>Final concentration of oxytocin in milliunits per milliliter (mu/mL)</li> <li>Date of bag preparation</li> <li>Initials of staff member preparing the bag</li> <li>Initials of staff member preparing and performing the independent double check of preparation.</li> </ul> |               | —             |       |                                                                                                                                 |
| Tubing and infusion pumps are labelled in a standard and consistent manner.                                                                                                                                                                                                                                                                                                                                                                                                | —             |               |       |                                                                                                                                 |
| <b>Recommendation #7: Standard Use of Oxytocin</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |               |               |       |                                                                                                                                 |
| <i>Each hospital will use a standardized oxytocin protocol and order set.</i>                                                                                                                                                                                                                                                                                                                                                                                              |               |               |       |                                                                                                                                 |
| The hospital has standardized order sets in place and that are consistently used.                                                                                                                                                                                                                                                                                                                                                                                          |               |               | —     |                                                                                                                                 |
| The standardized order sets include emergency procedures such as providing intrauterine resuscitation during infusion or using rescue agents during adverse events.                                                                                                                                                                                                                                                                                                        |               |               | —     |                                                                                                                                 |

## Safe Administration of Oxytocin Gap Analysis Tool



| RECOMMENDATIONS                                                                                                                                                                                                                                                                                                                                                                                                   | CURRENT STATE |               |       | ACTION (FUTURE STATE)                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|-------|-------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                   | Met           | Partially Met | Unmet | What tools and strategies does your organization need to implement to meet this recommendation? |
| <b>Recommendation #8: Independent Double-Check &amp; Smart Pump Use</b>                                                                                                                                                                                                                                                                                                                                           |               |               |       |                                                                                                 |
| <i>Independent double check to be obtained in preparing the medication and setting the initial pump infusion rate via a Smart Pump.</i>                                                                                                                                                                                                                                                                           |               |               |       |                                                                                                 |
| The hospital has a double check algorithm in place that is consistently used, which includes verification of the following: <ul style="list-style-type: none"> <li>• Correct patient</li> <li>• Correct initial order</li> <li>• Correct preparation of infusion</li> <li>• Correct labeling of infusion bag</li> <li>• Correct initial infusion pump settings and ensuring it is to the closest port.</li> </ul> |               | —             |       |                                                                                                 |
| Initial and ongoing staff training is provided and supported for implementation of the independent double check.                                                                                                                                                                                                                                                                                                  |               | —             |       |                                                                                                 |
| <b>Recommendation #9: Low-Dose Regimen</b>                                                                                                                                                                                                                                                                                                                                                                        |               |               |       |                                                                                                 |
| <i>Hospitals administering oxytocin for the purpose of augmentation and induction will follow a low-dose regimen.</i>                                                                                                                                                                                                                                                                                             |               |               |       |                                                                                                 |
| The hospital implements a low-dose oxytocin regimen/protocol to promote safe administration of oxytocin.                                                                                                                                                                                                                                                                                                          |               |               | —     |                                                                                                 |
| <b>Recommendation #10: Stopping &amp; Re-Starting Oxytocin Administration</b>                                                                                                                                                                                                                                                                                                                                     |               |               |       |                                                                                                 |
| <i>Health care providers are to be aware of when to stop, reduce and safely restart oxytocin administration.</i>                                                                                                                                                                                                                                                                                                  |               |               |       |                                                                                                 |
| Initial and ongoing training on when to stop, reduce and safely restart oxytocin is provided to the appropriate health care providers.                                                                                                                                                                                                                                                                            | —             |               |       |                                                                                                 |
| The MRP completes an in-person assessment before oxytocin is administered.                                                                                                                                                                                                                                                                                                                                        | —             |               |       |                                                                                                 |
| Rationale for initiating, increasing, reducing and stopping oxytocin are clearly documented by the administering health care provider.                                                                                                                                                                                                                                                                            | —             |               |       |                                                                                                 |
| <b>Recommendation #11: Patient Support in Labour</b>                                                                                                                                                                                                                                                                                                                                                              |               |               |       |                                                                                                 |
| <i>Pregnant patients in labour receiving an oxytocin infusion will receive continuous one-to-one care by a registered health care professional for support, advocacy, comfort measures, and monitoring.</i>                                                                                                                                                                                                       |               |               |       |                                                                                                 |
| Patients receiving oxytocin consistently have one-to-one (1:1) midwife or nurse-to-patient care for continuous support and monitoring in labour.                                                                                                                                                                                                                                                                  | —             |               |       |                                                                                                 |



## Background

The [Safe Administration of Oxytocin guideline report](#), developed by the Provincial Council for Maternal and Child Health (PCMCH) in 2019, outlines best practice recommendations for the safe management of pregnant patients whose labour is induced and/or augmented with the medication, oxytocin. The objective of the report is to reduce the risk of misuse and/or mismanagement of oxytocin by addressing risk factors that have contributed to common errors in its administration. To promote a culture of safety when using this high-alert medication, 11 best practice recommendations were identified and vetted by clinical experts. This toolkit is intended to support hospitals in identifying which best practice recommendations to prioritize and implement. It aims to support implementation by providing tools that can be applied in practice, bridging identified gaps and ultimately enhancing safety when administering oxytocin.

PCMCH has defined maternal levels of care for birthing hospitals in Ontario. The levels of care summarize hospitals' capacity to provide a standard suite of maternal health services. Induction of labour is a service available at all hospitals that are designated level 1b or higher. Hospitals that administer oxytocin are expected to have the requisite services, personnel and equipment to safely use oxytocin for induction and augmentation of labour. Level 1a hospitals may still provide induction services or augmentation of labour to meet the needs of their communities (including rural and remote settings) and the 11 recommendations outlined support best practice and safe oxytocin administration in these settings as well. The recommendations focus on application to low-risk pregnancies,<sup>1</sup> yet may apply to patients outside the defined low-risk pregnancy category. Individualized assessments and clinical judgement are required to ensure that care is tailored to meet the unique needs of every patient.

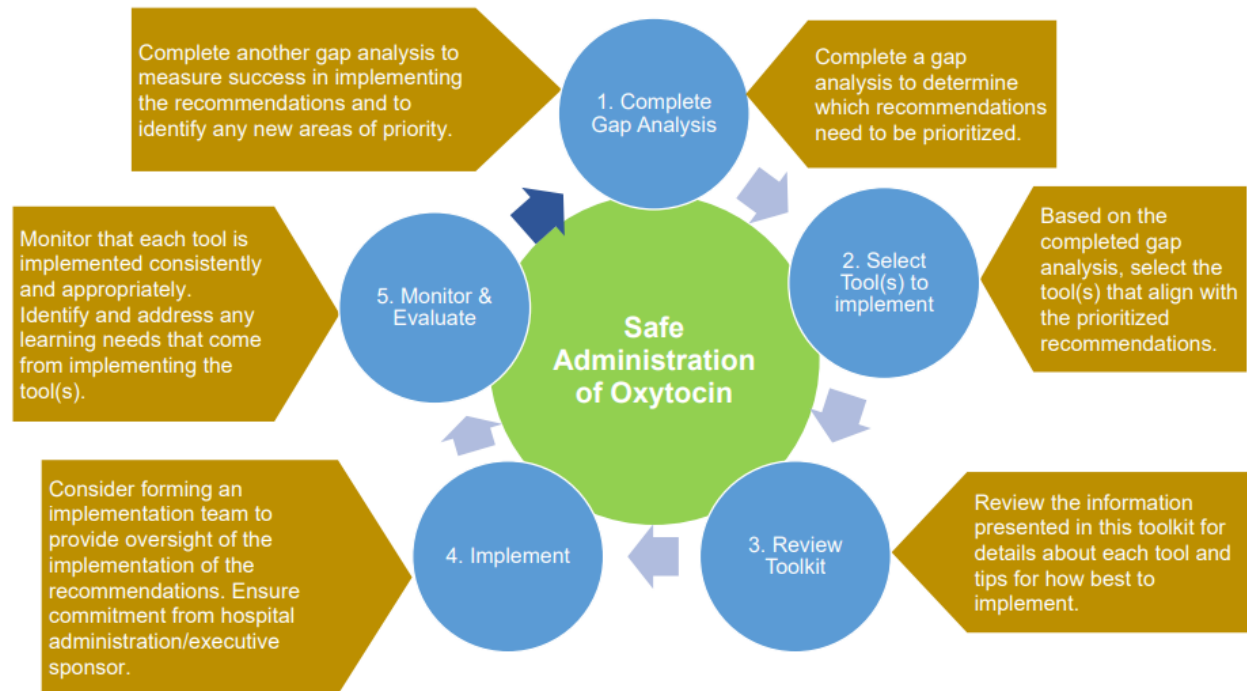
### Safe Administration of Oxytocin: Best Practice Recommendations

- |                                                    |                                                         |
|----------------------------------------------------|---------------------------------------------------------|
| <b>1</b> Shared Decision Making                    | <b>7</b> Standard Use of Oxytocin                       |
| <b>2</b> Inter-Professional Team Communication     | <b>8</b> Independent Double-Check and Smart Pump Use    |
| <b>3</b> Indications for Induction or Augmentation | <b>9</b> Low-Dose Regimen                               |
| <b>4</b> Professional Skills Training              | <b>10</b> Stopping & Restarting Oxytocin Administration |
| <b>5</b> Hospital Preparedness for Adverse Events  | <b>11</b> Patient Support in Labour                     |
| <b>6</b> Medication Handling                       |                                                         |

<sup>1</sup> For the purposes of this report, low-risk pregnancies are defined as pregnancies with a singleton, cephalic, term pregnancy ( $\geq 37$  weeks gestation) and excludes conditions such as any diabetes, hypertensive disorders in pregnancy, placenta previa, fetal anomalies, pre-existing hypertension and IUGR.

## How to Use this Toolkit

Successful implementation, adoption and sustained use requires that the recommendations in the *Safe Administration of Oxytocin* guideline report be tailored at the local level. This can be achieved by applying the resources included within this toolkit.



## Overview of Tools

This toolkit provides resources to support the implementation of the Safe Administration of Oxytocin recommendations. These recommendations were designed to mitigate maternal, fetal or neonatal risks associated with oxytocin administration. The tools include:

1. [Gap Analysis Template](#)..... pg. 5
2. Patient Resources (English and French).....pg. 6
  - a. [Oxytocin: To Help Start or Speed up Your Labour Patient Education Pamphlet](#)
  - b. [Oxytocin to Start or Advance Labour: 5 Questions to Ask Patient Handout](#)
3. [Communication Techniques](#).....pg. 8
  - a. Disagreeing with the plan of care algorithm
  - b. Deciding about medication administration algorithm
  - c. SBAR (Situation, Background, Assessment, Recommendations) Framework
  - d. I Pass the Baton
  - e. Team STEPPS
4. Oxytocin Safety Checklists.....pg. 11
  - a. [Pre-Use Checklist – Identifies patient eligibility and need for oxytocin](#)
  - b. [In-Use Checklist – Outlines safety considerations for monitoring of oxytocin](#)
5. [Standardized Order Set](#).....pg. 13
6. [Standardized Medication Labels](#).....pg. 18

These tools can be individually downloaded from the [PCMCH website](#).

### Clinical practice note:

Individualized assessment and clinical judgement are required to ensure that care meets the unique needs of all patients. It is critically important to assess the full clinical picture when applying these tools.

## Gap Analysis

### Gap Analysis Template

Use the template to determine the hospital's current state in relation to the *Safe Administration of Oxytocin* recommendations and identify potential areas for improvement. Document the current state using the gap analysis template by identifying to what extent each best practice recommendation is met, partially met or not met.

**Safe Administration of Oxytocin Recommendation(s)**  
Applies to ALL recommendations

#### Tips for Implementation

- The hospital's administration team can complete the tool.
- Use the tool to compare current institutional and individual practices by:
  - Reviewing current gaps and identifying why they exist.
  - Determining the desired outcomes and what gaps need to be filled to reach them.
  - Determining if and how a collaborative approach, such as a regional network, can help bridge an identified gap.
  - Prioritizing what gaps should be addressed with the greatest urgency and highest impact.

First page of the template showing what is assessed as being met, partially met or unmet (section to document action not shown):

| RECOMMENDATIONS                                                                                                                                                                           | CURRENT STATE |               |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|-------|
|                                                                                                                                                                                           | Met           | Partially Met | Unmet |
| <b>Recommendation #1: Shared Decision Making</b>                                                                                                                                          |               |               |       |
| <i>Patients are provided with information to participate in shared decision-making on oxytocin induction, augmentation, and</i>                                                           |               |               |       |
| A patient-oriented fact sheet or pamphlet to summarize oxytocin use is provided to every patient being considered to start on oxytocin.                                                   |               |               |       |
| Informed consent for starting oxytocin is obtained and documented by MRP upon admission and again prior to medication set-up                                                              |               |               |       |
| Informed consent discussion includes, but is not limited to:                                                                                                                              |               |               |       |
| <ul style="list-style-type: none"> <li>• maternal and fetal indications</li> <li>• benefits and risks of oxytocin administration</li> <li>• benefits and risks of alternatives</li> </ul> |               |               |       |
| <b>Recommendation #2: Inter-Professional Team Communication</b>                                                                                                                           |               |               |       |
| <i>Members of the health care team must maintain communication that is clear, direct, and respectful.</i>                                                                                 |               |               |       |
| The hospital/unit has an escalation process, or chain of command protocol, in place.                                                                                                      |               |               |       |
| The hospital/unit has a standardized transfer of accountability/handover process.                                                                                                         |               |               |       |
| Ongoing inter-professional team training and skills drills are provided and supported by clinical leadership.                                                                             |               |               |       |
| <b>Recommendation #3: Indications for Induction or Augmentation</b>                                                                                                                       |               |               |       |
| <i>The prescriber will order oxytocin for induction and/or augmentation for the appropriate indication(s).</i>                                                                            |               |               |       |
| Clinical decision-making tools about disagreeing with the plan of care as well as medication administration are used consistently, as required.                                           |               |               |       |
| Safety tools, such as checklists to ensure oxytocin is being used safely and for appropriate indications, are used consistently.                                                          |               |               |       |
| The cervix is assessed using the Bishop score to ensure that the pregnant patient has a favourable cervix ready for oxytocin administration.                                              |               |               |       |
| <b>Recommendation #4: Professional Skills Training</b>                                                                                                                                    |               |               |       |
| <i>Oxytocin is prescribed and administered by a trained health care professional educated on its use, including the effects</i>                                                           |               |               |       |
| Initial and ongoing (every two years) inter-professional FHS training for all health care providers who are involved in intrapartum fetal monitoring is provided and supported.           |               |               |       |

## Patient Resources

### Oxytocin: To Help Start or Speed up Your Labour Patient Education Pamphlet

This pamphlet supports pregnant patients and future parents in their decision-making and understanding around informed consent after an induction or augmentation with oxytocin has been recommended.

The pamphlet was created in collaboration with Best Start by Health Nexus and has been tested and validated by patients.

#### Safe Administration of Oxytocin Recommendation(s) #1: Shared Decision-Making

##### Tips for Implementation

- Provide hard copy versions of the pamphlet in waiting rooms and assessment rooms during antenatal visits.
- Use the pamphlet to guide conversations about oxytocin when obtaining informed consent.

Pamphlet is available in English and French.



## Patient Resources

### Oxytocin to Start or Advance Labour: 5 Questions to Ask Patient Handout

This handout provides information about the benefits and risks of intravenous oxytocin and can be used to support conversations between healthcare providers and their patients. It was developed by the Institute for Safe Medication Practices (ISMP) Canada in collaboration with patients, care providers and multiple provincial and national organizations.

#### Safe Administration of Oxytocin Recommendation(s) #1: Shared Decision Making

#### Tips for Implementation

- Provide hard copies in waiting rooms and assessment rooms during antenatal visits.
- Use the tool to supplement conversations about oxytocin to support obtaining informed consent.
- Review the [ISMP Canada Implementation Guide](#) for more tips on how to talk to patients about the use of oxytocin to start or advance labour.

The [Oxytocin to Start or Advance Labour: 5 Questions to Ask](#) handout is available in English and French.

#### Oxytocin to Start or Advance Labour: 5 Questions to Ask



##### 1. What is oxytocin?

- Oxytocin is a hormone that is produced naturally in pregnancy to make the uterus contract. When the uterus contracts, it is called labour.
- Oxytocin is also a medicine that is given during labour if the natural supply is not enough.



##### 2. Why is it used and what are the benefits?

- To help start labour (induction) or
- To help advance labour (augmentation) when the time between contractions is too long, the length of contractions is too short, or contractions are too weak.
- Oxytocin helps the uterus contract. The contractions open the cervix and help your baby move down into the birth canal.
- Oxytocin should only be used when the benefits of delivery outweigh the risks of continuing the pregnancy.
- Benefits may include being able to have a vaginal birth and not requiring a Caesarean delivery (C-section).
- In Canada, 8 out of 10 patients who requested oxytocin to start or advance labour gave birth vaginally.



##### 3. Proper Use: How is it given?

- Oxytocin to start or advance labour is given intravenously using a pump to control the amount of medicine you receive.
- The medicine will start at a low dose and then will be increased gradually to get the right contraction pattern for you.
- In some cases, if the medicine is affecting the baby's heart rate or if the contractions are too close together, your health care provider may reduce or stop the oxytocin.



##### 4. What are the risks?

- Risks to you and your baby can vary depending on your past or current health factors (e.g., heart conditions, blood pressure).

| Risks to the baby may include:                                                                                                                                                                                           | Risks to you may include:                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Heart rate changes (e.g., slow heart beat due to overly strong or frequent contractions)</li> <li>• Shortage of oxygen due to overly strong or frequent contractions</li> </ul> | <ul style="list-style-type: none"> <li>• Increased labour pain</li> <li>• Fast/strong heart rate or changes in blood pressure</li> <li>• Heavy bleeding or post-partum bleeding</li> <li>• Strong contractions that are too long or too frequent</li> <li>• Headache, nausea, vomiting</li> <li>• Tear in the uterus requiring an emergency C-section (rare)</li> </ul> |

Rarely oxytocin may cause serious or life-threatening harm to you or your baby, so it is important to have already discussed the risks and benefits of oxytocin use with your doctor or midwife before treatment is started.

- Other options may include waiting for labour to start, having a C-section, or using other medicines, each of which has its own benefits and risks—discuss with your doctor or midwife to determine what is best for you and your baby.



##### 5. Monitor: What do I watch for?

- Your baby's heart rate and your contractions will be closely monitored using a fetal monitor.
- Your health care team will check on you often and watch over your labour closely.
- Your contractions, blood pressure, and heart rate will be checked regularly.
- You may need to have pain medicine to help you with the pain of labour. You will be provided with choices to manage your pain.
- Let your health care team know right away if you have:
  - sudden onset of severe abdominal pain
  - heavy bleeding from your vagina

For more information about induction of labour visit  
[www.pregnancyinfo.ca/birth/labour/induction/](http://www.pregnancyinfo.ca/birth/labour/induction/)

Questions and Notes

Source: (Oxytocin, Medline) Database of Health Medication Reviews, 2019-2020. Canadian Institute for Health Information (CIHI). Reimbursement of the resources can be found through the Canadian Medication Safety Coalition.

| Communication Technique Examples                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Safe Administration of Oxytocin Recommendations(s) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| #2: Inter-professional Team Communication          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Name of Tool                                       | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| SBAR                                               | <p>This tool supports concise and urgent communications.</p> <p><b>Situation</b> - problem, patient, project<br/> <b>Background</b> - important information<br/> <b>Assessment</b> - your evaluation<br/> <b>Recommendations</b> - actions required</p> <p>For more information, please visit: IHI – SBAR Toolkit: <a href="https://bit.ly/2lZNwMg">https://bit.ly/2lZNwMg</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| I Pass The Baton                                   | <p>This tool guides communications around proper handoffs and health care transitions. The phrase is an acronym that denotes:</p> <p>Introduction, <b>P</b>atient, <b>A</b>ssessment, <b>S</b>ituation, <b>S</b>afety<br/> The <b>B</b>ackground, <b>A</b>ctions, <b>T</b>iming, <b>O</b>wnership, <b>N</b>ext</p> <p>For more information, please visit:</p> <ul style="list-style-type: none"> <li>ACOG – Communication Strategies for Patient Handoffs: <a href="https://bit.ly/2C9YgOs">https://bit.ly/2C9YgOs</a></li> <li>AHRQ – Team STEPPS system: <a href="https://bit.ly/2nAx32X">https://bit.ly/2nAx32X</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Team STEPPS system                                 | <p>This communication system is a compendium of evidence-based tools and techniques that help manage crucial conversations or “just in time” conversations. Examples of these are:</p> <ol style="list-style-type: none"> <li>Morning briefings</li> <li>Team Check-ups and Call-out strategies</li> <li>Debriefs on Accountability</li> <li>Using CUS language for patient advocacy, “<b>C</b>oncerned, <b>U</b>ncomfortable, this is a <b>S</b>afety issue”.</li> </ol> <p>It supports better management of conflicts by using a constructive positive approach to emphasize “<b>what</b> is right, not <b>who</b> is right” with DESC method:</p> <p><b>D</b>: Describe the specific behavior or situation.<br/> <b>E</b>: Express how the situation makes you feel or concerns you.<br/> <b>S</b>: Suggest other alternatives.<br/> <b>C</b>: Consequences stated in terms of team goals, not punishment.</p> <p>For a complete list of tools and strategies, please visit: AHRQ – Team STEPPS Guide: <a href="https://bit.ly/2v2A66o">https://bit.ly/2v2A66o</a></p> |

### Algorithm: Disagreeing with the Plan of Care

The algorithm will guide situations when there is disagreement with the plan of care. The decision tree provides steps that can be taken to resolve the issue.

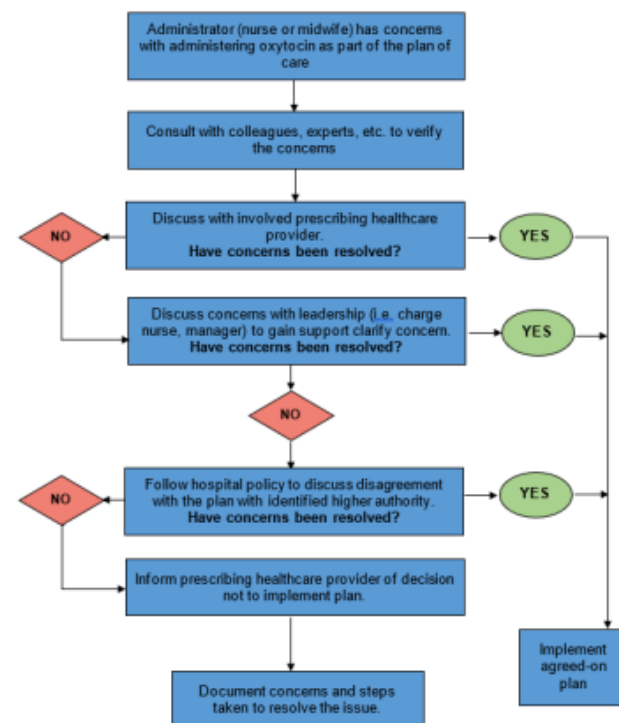
#### Safe Administration of Oxytocin Recommendation(s)

#2: Inter-professional Team Communication  
#3: Indications for Induction or Augmentation  
#4: Professional Skills Training

#### Tips for Implementation

- Use to support inter-professional team training and skills drills. Inter-professional Team Training and Skills Drills can potentially empower individuals to communicate more effectively and escalate concerns during oxytocin administration. Use case studies involving oxytocin administration to teach teams about how adverse events occur and strategies to address urgency [1].
- Use as the foundation for development and implementation "chain of command" protocol.
- Use alongside implementing standardized transfer of accountability or handover processes during shift change, breaks or transfers of care [2].

### Safe Administration of Oxytocin Decision Tree: Disagreeing with the Plan of Care<sup>1</sup>



1. Source: Adapted from CNO, "CNO Practice Guidelines: Disagree With the Plan of Care", June 2009

### Algorithm: Deciding about Medication Administration

This algorithm guides team decision-making amongst health care providers about medication, specifically with respect to IV oxytocin.

#### Safe Administration of Oxytocin

##### Recommendation(s)

#2: Inter-professional Team Communication

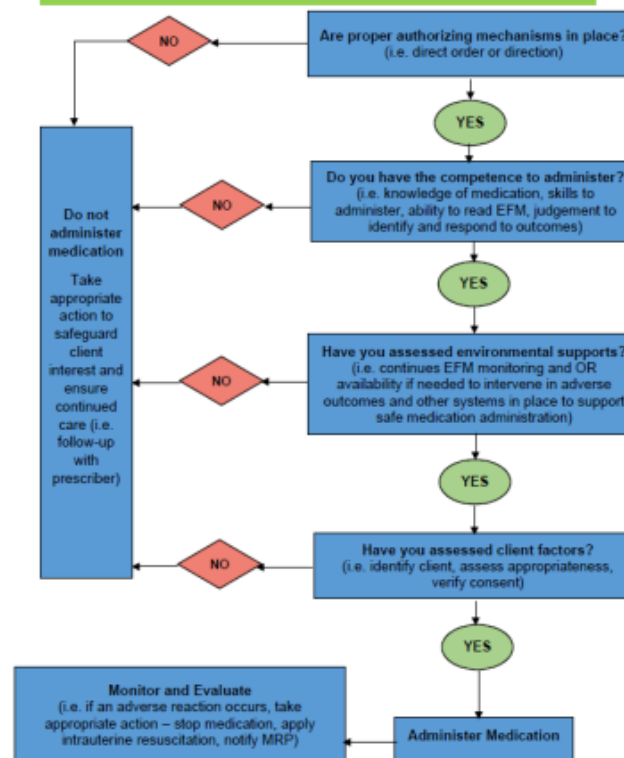
#3: Indications for Induction or Augmentation

#4: Professional Skills Training

#### Tips for Implementation

- Use to support inter-professional team training and skills drills.
- Use as the foundation for development and implementation "chain of command" protocol.

### Safe Administration of Oxytocin Decision Tree: Deciding About Medication Administration<sup>1</sup>



1. Source: Adapted from CNO, "CNO Practice Guidelines: Medication", Revised 2017

### Pre-Use Oxytocin Safety Checklist

This checklist was adapted from a validated tool by the HCA Perinatal Safety Initiative [6].

The checklist provides an opportunity for healthcare providers to pause and reflect on a patient's eligibility and safety considerations prior to administering oxytocin.

Note: Individual assessment and clinical judgement may determine that continued oxytocin use is best for the birthing individual and baby. The MRP should document their assessment, review of fetal heart rate tracing and orders.

#### Safe Administration of Oxytocin Recommendation(s)

#2: Inter-Professional Team Communication

#4: Professional Skills Training

#9: Low-Dose Regimen

#10: Stopping and Re-Starting Oxytocin.

#### Tips for Implementation

- Create an implementation team to support training and ongoing education on the benefits of checklist use
- Identify champions to support ongoing coaching and education.
- Consider auditing checklist use.
- Use the checklist as a prompt for discussion amongst care team members as to why extenuating circumstances may mean a patient varies from the checklist.
- Ensure accurate documentation is completed if the checklist is not embedded in the electronic medical record.



### Pre-Use Oxytocin Safety Checklist<sup>1</sup>

If the following checklist cannot be completed, oxytocin should not be initiated.

- ☐ Current history, physical, and perinatal record in the chart<sup>2</sup>.
- ☐ Indication for induction or augmentation with oxytocin is documented in the patient's health record.
- ☐ Patient demonstrates understanding of benefits and risks associated with oxytocin administration and verbal consent is received and documented by MRP in patient's chart.
- ☐ Patient has no contraindication for vaginal delivery.
- ☐ Unit acuity has been assessed and physician, and/or other health care team members are aware of the induction/augmentation and are readily available in the event of an emergency.
- ☐ Cervical status is assessed and documented.
- ☐ Fetal presentation is assessed and documented.
- ☐ Appropriate FHS assessment has been performed. The FHR pattern is normal, and has been documented (prior to induction, a normal 20-minute Non-Stress Test (NST); or prior to augmentation, a normal FHR has been observed on EFM).
- ☐ Order signed and in chart.

#### Notes:

1. Low-Risk Pregnant Patients: This checklist was developed to support the safe management of pregnant patients whose labour is induced or augmented with oxytocin and focuses on low-risk patients with a singleton, cephalic, term pregnancy. It may also be applicable to patients outside of this definition.
2. This may be delayed for non-elective admissions. Hospitals should obtain the patient's Ontario Perinatal Record 1 and 2; however, in the event it is not available, the physician/midwife should perform a thorough assessment of the patient (including collecting past clinical history and bishop scoring) to determine eligibility for oxytocin.

This checklist represents a guideline for care; however, individualized medical care is directed by the primary care provider.

Source: Adapted from the HCA Healthcare Perinatal Safety Initiative, Pre-Oxytocin Checklist, 2009.

| In-Use Oxytocin Safety Checklist                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This checklist was adapted from a validated tool by the HCA Perinatal Safety Initiative and aligns with the <a href="#">Society of Obstetricians and Gynaecologists (SOGC) No. 396 Fetal Health Surveillance: Intrapartum Consensus Guideline</a> to serve the Ontario system and compliment the recommendations in the report [6].</p> <p>The checklist provides an opportunity for healthcare providers to pause and reflect on safety considerations while administering oxytocin. This checklist can help support staff in identifying when to stop and/or restart an oxytocin infusion to maintain patient safety.</p> <p><u>Safe Administration of Oxytocin Recommendation(s)</u><br/>           #2: Inter-Professional Team Communication<br/>           #4: Professional Skills Training<br/>           #9: Low-Dose Regimen<br/>           #10: Stopping and Re-Starting Oxytocin.</p> <p><u>Tips for Implementation</u></p> <ul style="list-style-type: none"> <li>• See tips above for Pre-Use Oxytocin Safety Checklist</li> <li>• Place the laminated checklist by the electronic fetal monitor as a visual cue for staff monitoring the tracing.</li> <li>• Recommend that all perinatal care providers complete fetal health surveillance education/training every two years.</li> </ul> | <div style="text-align: right;">  </div> <h3 style="text-align: center;">In-Use Oxytocin Safety Checklist<sup>1</sup></h3> <p>This checklist will be successfully completed every 30 minutes (+/- 5min) while oxytocin is in use.</p> <p><b>If this checklist cannot be completed, oxytocin must be decreased or stopped<sup>2</sup>.</b></p> <p><input type="checkbox"/> <b>Continuous EFM Assessment shows:</b></p> <ul style="list-style-type: none"> <li>o Normal EFM tracing for each of the 2, 15-minute (+/- 5 minutes) segments of FHS in the last 30 minutes (i.e. baseline within normal range, moderate variability. No or non-repetitive uncomplicated decelerations).</li> <li>o No more than 1, 15-minute segment where the EFM is Atypical.</li> <li>o No more than 1 late deceleration occurred.</li> <li>o No more than 2 complicated variable decelerations within the previous 30 minutes.</li> </ul> <p><input type="checkbox"/> <b>Uterine Contractions</b></p> <ul style="list-style-type: none"> <li>o No more than 5 contractions in a 10-minute window, averaged over 30 minutes.</li> <li>o No contraction with a duration greater than 90 seconds.</li> <li>o Uterus palpates soft between contractions for a minimum of 30 seconds.</li> <li>o If IUPC is in place, measured uterine resting tone is less than 25 mm Hg for at least 30 seconds between each contraction.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Notes:</b></p> <p>1. This checklist was developed to support the safe management of pregnant patients whose labour is induced or augmented with oxytocin and focuses on low-risk patients with a singleton, cephalic, term pregnancy. It may also be applicable to patients outside of this definition.</p> <p>2. This checklist represents a guideline for care; however, individualized medical care is directed by the primary care provider. If oxytocin is stopped, the pre-oxytocin checklist should be reviewed before oxytocin is restarted.</p> <p><small>Source: Adapted from the HCA Healthcare Perinatal Safety Initiative, Oxytocin "In Use" Checklist, 2009</small></p> </div> |

## Standardized Order Set

This order set aims to reduce medication errors and ensure accurate and transparent drug administration to avoid dose omission. It will help mitigate adverse events stemming from misuse of oxytocin and help prevent common errors with IV oxytocin.

### Safe Administration of Oxytocin Recommendation(s)

- #7: Standardized Use
- #8: Independent Double Check and Smart Pumps
- #9: Low-Dose Regimen
- #10: Stopping and Re-Starting Oxytocin.

### Tips for Implementation

- See related tips above for safety checklists.
- Embed in electronic medical records where possible.
- Tailor the order set to follow the hospital's official standard format.
- Implement an independent double check with two regulated healthcare providers reviewing the order set once signed by the administering care provider.

First page of the order set:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                    |                       |                        |  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | Hospital Name/Logo |                       | Patient Identification |  |
| <b>Labor and Delivery Order Set</b><br><b>Oxytocin Induction and Augmentation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                    |                       |                        |  |
| <b>Allergies</b> <input type="checkbox"/> No Known Allergies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                    |                       |                        |  |
| <b>Date prescribed:</b><br>Month / Day / Year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                    | <b>Time:</b><br>00:00 |                        |  |
| <b>Admission</b><br><input type="checkbox"/> Admit to Labour and Delivery Unit under attending MRP. Refer to hospital Admission Order set.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                    |                       |                        |  |
| <b>Prior to Commencing Oxytocin:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Patient consent for the administration of oxytocin for the induction or augmentation of labour is documented.</li> <li><input type="checkbox"/> Patient is examined vaginally and has a Bishop score documented.</li> <li><input type="checkbox"/> Patient has no contraindications to vaginal birth, such as placenta previa or vasa previa, prior classic uterine incision or other uterine surgeries that contraindicate attempts at vaginal delivery, and/or prolapsed cord.</li> <li><input type="checkbox"/> Continuous electronic fetal monitoring (EFM) for at least 20 minutes (to confirm a normal fetal heart rate (FHR) pattern and uterine activity (UA)). If EFM tracing is atypical or abnormal, notify the MRP immediately (SOGC, 2007).</li> <li><input type="checkbox"/> 6 hours has passed since the last dose of prostaglandins gel (Prostin, Prepidil) (SOGC, 2013).</li> <li><input type="checkbox"/> 4 hours has passed since the last dose of misoprostol (SOGC, 2013).</li> <li><input type="checkbox"/> 30mins has passed since the removal of a dinoprostone insert (Cervidil) (SOGC, 2013).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                    |                       |                        |  |
| <b>Monitoring During Oxytocin Infusion:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Continuous electronic fetal monitoring (CPPC, 2018; RCOG, 2001).</li> <li><input type="checkbox"/> Electronic fetal monitoring may be interrupted for periods of up to 30 minutes in the first stage of labour (if tracing is normal, maternal-fetal condition is stable, and the infusion rate of oxytocin has not been increased in the last 30 minutes) to allow for ambulation, personal care, and hydrotherapy (SOGC, 2020; CPPC, 2020).</li> <li><input type="checkbox"/> Assess and document the FHR and UA assessment findings:           <ul style="list-style-type: none"> <li>o q15 minutes during first stage of labour and before the onset of pushing in the second stage (CPPC, 2018; SOGC, 2007).</li> <li>o q15 minutes during active second stage, once the woman has begun pushing (CPPC, 2020; SOGC, 2020).</li> <li>o Maternal heart rate, respirations, and blood pressure q30min and pm. <b>Notify MRP if vitals outside normal limits.</b></li> <li>o Maternal temperature q4h if membranes intact, q2h once membranes have ruptured and pm. (Ferry et al., 2017). <b>Notify MRP if temperature is greater than 38°C.</b></li> <li>o Monitor intake and output and observe for signs of water intoxication/hyponatremia (e.g., lethargy, ataxia, confusion, seizures).</li> <li>o Vaginal examination q2-4h or PRN for labour progress in the first stage (Perinatal Services BC, 2011).</li> <li>o Vaginal examination q1h in the active second stage (Perinatal Services BC, 2011).</li> </ul> </li> <li><input type="checkbox"/> Notify MRP immediately when any signs of the following occur:           <ul style="list-style-type: none"> <li>o Atypical or abnormal FHR</li> <li>o Tachysystole (defined over 30 minutes)</li> <li>o Excessive vaginal bleeding</li> </ul> </li> </ul> |  |                    |                       |                        |  |

## Standardized Order Set – Page 2

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Medication</b><br><input type="checkbox"/> Primary IV initiated with maintenance infusion of <input type="checkbox"/> 0.9% Sodium Chloride OR <input type="checkbox"/> Ringers Lactate at <input type="text"/> mL/hr on IV smart pump <span style="float: right;">1</span><br><input type="checkbox"/> Oxytocin infusion <input type="text"/> units in 500 mL of <input type="checkbox"/> 0.9% Sodium Chloride OR <input type="checkbox"/> Ringers Lactate on IV smart pump <span style="float: right;">2, 3</span><br>Note: Final concentration of solution is Oxytocin 20 milliunits/mL.<br><input type="checkbox"/> Piggyback oxytocin infusion onto primary IV line connected at port closest to the patient.<br><input type="checkbox"/> Independent double check performed for initial pump set up as per table 2.4 <span style="float: right;">4</span><br><input type="checkbox"/> Low Dose Protocol <span style="float: right;">5</span> <ul style="list-style-type: none"> <li>Start oxytocin infusion at <input type="checkbox"/> 1 milliunits/minute (3 mL/hour) OR <input type="checkbox"/> 2 milliunits/minute (6 mL/hour).</li> <li>Increase the rate by <input type="checkbox"/> 1 milliunits/minute (3 mL/hour) OR <input type="checkbox"/> 2 milliunits/minute (6 mL/hour) q 30 minutes, as needed, until a normal uterine contraction pattern is achieved. Refer to table 1 for dosage chart and table 3 for definition of normal uterine contraction pattern.</li> <li>Do not exceed a rate of 12 milliunits/minute without reassessment and/or verbal order from MRP.</li> <li>Do not exceed a rate of 20 milliunits/minute without a written order from the MRP. MRP reassessment required at 20 milliunits/minute, and if required a maximum infusion rate of 30 milliunits/minute may be ordered. <span style="float: right;">6, 7</span></li> </ul> |  |
| <b>Reduce Oxytocin</b> <span style="float: right;">8</span><br><input type="checkbox"/> In the event of atypical FHS (as defined in table 5), reduce the oxytocin infusion rate by half or stop oxytocin infusion.<br><input type="checkbox"/> In the event of tachystole (as defined in table 3) with a normal or atypical FHS, decrease oxytocin to half the rate or stop oxytocin infusion.<br><input type="checkbox"/> Apply intrauterine resuscitation interventions as defined in Intrauterine Resuscitation table 4 below.<br><input type="checkbox"/> Document clinical actions and notify MRP when oxytocin decreased.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| <b>Stop Oxytocin</b><br><input type="checkbox"/> In the event of an abnormal FHS (as defined in table 5), stop oxytocin immediately.<br><input type="checkbox"/> In the event of tachystole (as defined in table 3) with an abnormal FHS, stop oxytocin immediately.<br><input type="checkbox"/> Apply intrauterine resuscitation interventions as defined in Intrauterine Resuscitation (table 4). <span style="float: right;">9</span><br><input type="checkbox"/> Document clinical actions and notify MRP when oxytocin discontinued.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| <b>Restart Orders</b><br><input type="checkbox"/> Restart oxytocin at half the rate IF: it has been discontinued for less than 30mins, and the FHR tracing and contraction pattern are normal.<br><input type="checkbox"/> Restart oxytocin at initial starting dose IF: it has been discontinued for 30mins or longer, the FHR tracing and contraction pattern are normal, and a complete fetal and maternal assessment has been discussed with the MRP prior to restarting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
| <b>Additional Order</b><br><hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| <b>Ordering MRP</b><br>Print Name: _____ Signature: _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |

### Rationale and Supporting Information

1. Patients should receive a **maintenance infusion rate** in their primary IV line. This infusion rate can be higher or lower, depending on the most responsible practitioner's (MRP) assessment and if the patient is at risk of fluid overload.

2. This **diluted solution** is recommended to ensure safe administration and reduce risk of errors. This will require 1 ampule (equivalent to 10 international units (IU) per infusion which will minimize preparation errors and drug wastage.

3. Oxytocin should be diluted in **non-dextrose intravenous fluid** to prevent hyponatremia and glucose instability.

4. Integrate an **independent double check** in the order set for the initial pump setup to minimize opportunities for error. This may differ depending on organization-specific procedures, but should follow principles from the [ISMP of Canada](#).

5. A **low dose protocol** is recommended as it is the most conservative approach. Starting the infusion at 1-2 mU/minute and increasing the rate by 1-2 mU/minute is dependent on clinical judgement that considers the patient's clinical history and FHR findings. For example, those attempting a TOLAC may benefit from conservative administration starting at 1 mU/min and increasing by 1mU/min rather than starting at and increasing by 2 mU/min.

6. **Soft stop/safety checkpoint** – Most patients will have adequate contraction pattern between 8-12mU; hence a soft stop has been added here to cue the need to reassess. Administrator or MRP should assess patient to determine if adequate contraction pattern has been achieved. MRP can be contacted for a verbal order to continue with oxytocin increases if needed. This should correspond to a soft stop on the infusion pump.

7. **Hard stop** – Exceeding a hard stop should require a written order (and therefore a reassessment of the patient/fetal status). This should correspond to a hard stop on the infusion pump. Any dose higher than 20mU/min requires the administrator to select override on the pump for every dose change.

8. Reducing the infusion rate or stopping oxytocin should align with the in-use safety checklist.

9. Interventions must be included within the order set and documented; they are outlined in table 4 with this order set.

## Standardized Order Set – Information Tables

**Table 1: Oxytocin Dosage Rate**

| Oxytocin 10 International Units (IU) in 500 mL of IV fluid (20 milliunits/mL) |             |                      |             |
|-------------------------------------------------------------------------------|-------------|----------------------|-------------|
| Dose                                                                          | Rate / Hour | Dose                 | Rate / Hour |
| 1 milliunits/minute                                                           | 3 mL/h      | 11 milliunits/minute | 33 mL/h     |
| 2 milliunits/minute                                                           | 6 mL/h      | 12 milliunits/minute | 36 mL/h     |
| 3 milliunits/minute                                                           | 9 mL/h      | 13 milliunits/minute | 39 mL/h     |
| 4 milliunits/minute                                                           | 12 mL/h     | 14 milliunits/minute | 42 mL/h     |
| 5 milliunits/minute                                                           | 15 mL/h     | 15 milliunits/minute | 45 mL/h     |
| 6 milliunits/minute                                                           | 18 mL/h     | 16 milliunits/minute | 48 mL/h     |
| 7 milliunits/minute                                                           | 21 mL/h     | 17 milliunits/minute | 51 mL/h     |
| 8 milliunits/minute                                                           | 24 mL/h     | 18 milliunits/minute | 54 mL/h     |
| 9 milliunits/minute                                                           | 27 mL/h     | 19 milliunits/minute | 57 mL/h     |
| 10 milliunits/minute                                                          | 30 mL/h     | 20 milliunits/minute | 60 mL/h     |

**Table 2: Independent Double Check for Initial Pump Set Up**

| Independent Double Check for Initial Pump Set Up                                                                                                                                                                                                                                    |                                                |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------|
| <i>To be performed and signed by two regulated health care professionals (e.g., RN, RM, MD).</i>                                                                                                                                                                                    |                                                |         |
| CHECK 1                                                                                                                                                                                                                                                                             |                                                | CHECK 2 |
|                                                                                                                                                                                                                                                                                     | Correct Patient                                |         |
|                                                                                                                                                                                                                                                                                     | Correct Drug                                   |         |
|                                                                                                                                                                                                                                                                                     | Correct Drug Concentration (on bag)            |         |
|                                                                                                                                                                                                                                                                                     | Correct Programmed Concentration on Smart Pump |         |
|                                                                                                                                                                                                                                                                                     | Correct rate (in milliunits/minute)            |         |
|                                                                                                                                                                                                                                                                                     | Correct IV Line and Port Connection            |         |
| <div> <div>Check 1:</div> <div> <div>_____</div> <div>Printed Name</div> </div> <div> <div>_____</div> <div>Signature</div> </div> </div> <div> <div>Check 2:</div> <div> <div>_____</div> <div>Printed Name</div> </div> <div> <div>_____</div> <div>Signature</div> </div> </div> |                                                |         |

## Standardized Order Set – Information Tables

Tables 3, 4 and 5 are sourced from the SOGC No. 396 Fetal Health Surveillance: Intrapartum Consensus Guideline [7]. The content is intended to support understanding and utilization of the above Order Set.

| Table 3: Classification of Normal Uterine Activity and Tachysystole                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SOGC Clinical Practice Guideline, Fetal Health Surveillance: Intrapartum Consensus Guideline (No. 396 March 2020)                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Normal</b> <ul style="list-style-type: none"> <li>• <b>Frequency:</b> 5 or less contractions in a 10-minute window, averaged over 30 minutes</li> <li>• <b>Duration:</b> Less than 90 seconds</li> <li>• <b>Intensity:</b> Mild, moderate or strong by fundal palpation, <b>OR</b> IUPC &gt;25 mm Hg and &lt;75 mm Hg above the baseline except in second stage</li> <li>• <b>Resting tone:</b> Uterus soft on palpation for a minimum of 30 seconds between contractions, <b>OR</b> IUPC &lt;25 mm Hg</li> </ul> |
| <b>Tachysystole</b><br>Includes any of the following criteria: <ul style="list-style-type: none"> <li>• <b>Frequency:</b> 6 or more contractions in a 10-minute window, averaged over 30 minutes</li> <li>• <b>Duration:</b> More than 90 seconds</li> <li>• <b>Resting tone:</b> Resting period between contractions of &lt;30 seconds <b>OR</b> the uterus remains firm or &gt;25 mm Hg between contractions</li> </ul>                                                                                            |

| Table 4: Intrauterine resuscitation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SOGC Clinical Practice Guideline, Fetal Health Surveillance: Intrapartum Consensus Guideline (No. 396 March 2020)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| The goal of intrauterine resuscitation is to improve uterine blood flow, umbilical circulation, and maternal–fetal oxygenation. Actions may include: <ul style="list-style-type: none"> <li>• Remove vaginal PGE<sub>2</sub>/ <b>Stop or decrease oxytocin</b></li> <li>• Change maternal position to left or right lateral</li> <li>• Check maternal vital signs, including differentiation of maternal heart rate from fetal heart rate</li> <li>• Ask patient to modify or pause pushing efforts in the active second stage of labour</li> <li>• Improve maternal hydration, with an intravenous fluid bolus, only if indicated (i.e., maternal hypovolemia and/or hypotension); be aware of patient's fluid balance</li> <li>• Perform vaginal examination to rule out cord prolapse and assess progress</li> <li>• Consider tocolysis in the presence of tachysystole with atypical or abnormal tracing (e.g., with intravenous nitroglycerine). Although sublingual is frequently used, it is not effective.</li> <li>• Consider amnioinfusion in the presence of complicated variable decelerations</li> <li>• Provide supportive care to reduce maternal anxiety (to lessen catecholamine impact)</li> <li>• Consider oxygen by mask only when maternal hypoxia and/or hypovolemia is suspected/confirmed. Oxygen is reserved for maternal resuscitation in the presence of maternal hypoxia or hypovolemia, NOT for fetal resuscitation.</li> </ul> |

## Standardized Order Set – Information Tables

**Table 5: Classification of Intrapartum EFM Tracings**

**SOGC Clinical Practice Guideline, Fetal Health Surveillance: Intrapartum Consensus Guideline (No. 396 March 2020)**

|                                                           | Normal                                                                                                                                                                                                                                                                                                            | Atypical                                                                                                                                                                                                                                                  | Abnormal                                                                                                                                                                                              |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Uterine activity</b>                                   | <ul style="list-style-type: none"> <li>• Normal contraction pattern</li> </ul>                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Tachysystole may be present with normal, atypical, or abnormal tracings; monitor closely for concerning FHR characteristics</li> </ul>                                                                           |                                                                                                                                                                                                       |
| <b>Baseline</b>                                           | <ul style="list-style-type: none"> <li>• 110–160 bpm</li> </ul>                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• 100–110 bpm</li> <li>• &gt; 160 bpm for 30–80 minutes</li> <li>• Rising baseline</li> <li>• Arrhythmia (Irregular rhythm)</li> </ul>                                                                             | <ul style="list-style-type: none"> <li>• &lt; 100 bpm</li> <li>• &gt; 160 bpm for &gt; 80 minutes</li> <li>• Erratic baseline</li> </ul>                                                              |
| <b>Variability</b>                                        | <ul style="list-style-type: none"> <li>• 6–25 bpm</li> <li>• ≤ 5 bpm for &lt; 40 minutes</li> </ul>                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>• ≤ 5 bpm for 40–80 minutes</li> </ul>                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• ≤ 5 bpm for &gt; 80 minutes</li> <li>• ≥ 25 bpm for &gt; 10 minutes</li> <li>• Sinusoidal</li> </ul>                                                         |
| <b>Acceleration</b>                                       | <ul style="list-style-type: none"> <li>• Spontaneous accelerations but not required</li> <li>• Acceleration with scalp stimulation</li> </ul>                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Absence of acceleration with scalp stimulation</li> </ul>                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Usually absent (accelerations, if present, do not change classification of tracing)</li> </ul>                                                               |
| <b>Deceleration</b>                                       | <ul style="list-style-type: none"> <li>• None</li> <li>• Non-repetitive uncomplicated variable decelerations</li> <li>• Early decelerations</li> </ul>                                                                                                                                                            | <ul style="list-style-type: none"> <li>• Repetitive uncomplicated variables</li> <li>• Non-repetitive complicated variables</li> <li>• Intermittent late decelerations</li> <li>• Single prolonged deceleration ≥ 2 minutes but &lt; 3 minutes</li> </ul> | <ul style="list-style-type: none"> <li>• Repetitive complicated variables</li> <li>• Recurrent late decelerations</li> <li>• Single prolonged deceleration ≥ 3 minutes but &lt; 10 minutes</li> </ul> |
| <b>Interpret clinically (in light of total situation)</b> | <ul style="list-style-type: none"> <li>• No evidence of fetal compromise</li> </ul>                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>• Physiologic response</li> </ul>                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Possible fetal compromise</li> </ul>                                                                                                                         |
| <b>Terminology</b>                                        | <p><b>Recurrent:</b> Decelerations occur with ≥ 50% of uterine contractions in any 20-minute window.<br/> <b>Intermittent:</b> Decelerations occur with &lt; 50% of uterine contractions in any 20-minute segment.<br/> <b>Repetitive:</b> ≥ 3 in a row<br/> <b>Non-repetitive:</b> 1 or maximally 2 in a row</p> |                                                                                                                                                                                                                                                           |                                                                                                                                                                                                       |

EFM: electronic fetal monitoring; FHR: fetal heart rate.

## Standardized Medication Labels

These labels support communication, help prevent drug mix-ups and may reduce the chances of missing warning labels. Use of labels can contribute to the safe use of oxytocin.

### Safe Administration of Oxytocin Recommendation(s) #6: Medication Handling

#### Tips for Implementation

- See tips above for safety checklists.
- When creating labels, include:
  - Patient's name
  - Drug name
  - Amount
  - Concentration
  - Date/time
  - HIGH-ALERT status
  - Administered by:
  - Checked by:
- Engage pharmacists in discussions and decision-making around label use.

Figure 1: Label for reconstituted oxytocin IV bag

Figure 2: Adult syringe label for oxytocin

Figure 3: IV line label for oxytocin

## References

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- [1] Agency for Healthcare Research and Quality, "AHRQ Safety Program for Perinatal Care - Safe Medication Administration Oxytocin," Rockville, 2017.
- [2] Canadian Perinatal Programs Coalition, "Fundamentals of Fetal Health Surveillance Online Manual", 2018
- [3] College of Nurses of Ontario, "Practice Guideline: Disagreeing With the Plan of Care," Toronto, 2009.
- [4] College of Nurses of Ontario, "Practice Standard: Medication," College of Nurses of Ontario, Toronto, 2017.
- [5] Healthcare Insurance Reciprocal of Canada [HIROC] and the Canadian Medical Protective Association [CMPA], "Delivery in Focus: Strengthening obstetrical care in Canada," Ottawa, 2018.
- [6] Hospital Corporation of America, "HCA Perinatal Safety Initiative," 2009.
- [7] Society of Obstetricians and Gynaecologists of Canada, "Fetal Health Surveillance: Intrapartum Consensus Guideline. No 396," Journal of Obstetricians and Gynaecologists of Canada, 2020.
- [8] Perinatal Services BC, "Registered Nurse Initiated Activities Decision Support Tool No. 4: Evaluation of Progress of Labour/Dystocia", 2011
- [9] Royal College of Obstetricians and Gynaecologists, "Induction of Labour Evidence-based Clinical Guideline," 2001.

## Appendix 5: CMNRP IOL Toolkit: Indications for IOL



CHAMPLAIN MATERNAL NEWBORN REGIONAL PROGRAM  
PROGRAMME RÉGIONAL DES SOINS À LA MÈRE  
ET AU NOUVEAU-NÉ DE CHAMPLAIN

| Indications for IOL                                                                                 |                          |                                                                                                                                                                           |                          |
|-----------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Was the Indication for induction documented?                                                        |                          | Were there any contraindications?                                                                                                                                         |                          |
| Yes                                                                                                 | <input type="checkbox"/> | Yes                                                                                                                                                                       | <input type="checkbox"/> |
| No                                                                                                  | <input type="checkbox"/> | No                                                                                                                                                                        | <input type="checkbox"/> |
| Indication(s) documented (tick all that apply)                                                      |                          |                                                                                                                                                                           |                          |
| Severe Preeclampsia, HELLP Syndrome or Eclampsia at any gestational age                             | <input type="checkbox"/> | Dichorionic/Diamniotic twins, otherwise uncomplicated, 37-38 weeks                                                                                                        | <input type="checkbox"/> |
| Preeclampsia, greater than or equal to 34 weeks                                                     | <input type="checkbox"/> | EFW 5th to 10th percentile, otherwise uncomplicated greater than or equal to 39 weeks                                                                                     | <input type="checkbox"/> |
| Abnormal fetal surveillance                                                                         | <input type="checkbox"/> | Type 1, Type 2 or GDM on insulin, uncomplicated, 38-39 weeks                                                                                                              | <input type="checkbox"/> |
| EFW less than the 10th percentile WITH other abnormal FHS parameters                                | <input type="checkbox"/> | Gestational hypertension or pre-existing hypertension, with or without medication(s) greater than or equal to 39 weeks, with well controlled BP and NO adverse conditions | <input type="checkbox"/> |
| EFW less than the 5th percentile, otherwise uncomplicated greater than or equal to 37 weeks         | <input type="checkbox"/> | Cholestasis: greater than or equal to 39 weeks with clinical diagnosis OR Bile salts less than 40mmol/L;                                                                  | <input type="checkbox"/> |
| Monochorionic/Diamniotic twins 36-37 weeks                                                          | <input type="checkbox"/> | Cholestasis: less than 39 weeks if Bile salts are greater than 40mmol/L (Suggest inpatient)                                                                               | <input type="checkbox"/> |
| Significant maternal medical disease OR fetal complication                                          | <input type="checkbox"/> | Fetal demise, genetic or anatomic indications                                                                                                                             | <input type="checkbox"/> |
| TERM Pre-labour SROM GBS +/-                                                                        | <input type="checkbox"/> | Postdates, greater than or equal to 41 weeks                                                                                                                              | <input type="checkbox"/> |
| Gestational diabetes (diet managed) greater than or equal to 39 weeks, otherwise uncomplicated      | <input type="checkbox"/> | Pre-pregnancy BMI greater than or equal to 40 kg/m2, otherwise uncomplicated, greater than or equal to 39-40 weeks                                                        | <input type="checkbox"/> |
| AMA (greater than or equal to 40 years), otherwise uncomplicated, greater than or equal to 40 weeks | <input type="checkbox"/> | VTE or additional thrombotic disorders receiving anticoagulation therapy, greater than or equal to 38 weeks                                                               | <input type="checkbox"/> |

## Appendix 6: FIP Congress 2024 Acceptance



**82<sup>nd</sup> FIP World Congress**  
**of Pharmacy and Pharmaceutical Sciences**  
[capetown2024.fip.org](https://capetown2024.fip.org)

Dear Rebecca Marie Falzon,

Thank you for having submitted the above abstract for the 82<sup>nd</sup> FIP World Congress of Pharmacy and Pharmaceutical Sciences 2024, to be held in Cape Town, South Africa from 1-4 September 2024.

On behalf of the Congress Programme Development Group, it is our great pleasure to inform you that the abstract/abstracts below has/have been accepted for poster presentation.

### Accepted for Poster Presentations

|                          |                                                                             |
|--------------------------|-----------------------------------------------------------------------------|
| <b>Title</b>             | Best practice implementation strategy for the use of Oxytocin during labour |
| <b>Paper Number</b>      | 966                                                                         |
| <b>Paper Status</b>      | Abstract Proposal: Accepted as Poster Presentation                          |
| <b>Theme</b>             | (SEC) Hospital pharmacy                                                     |
| <b>Presenting Author</b> | Professor Lilian M Azzopardi                                                |

## Appendix 7: Obstetric Pharmacist Triage Tool

|                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                   |       |             |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------|-------|-------------|
| <div style="border: 1px solid black; width: 100px; height: 60px; margin: 0 auto; text-align: center; line-height: 60px;">[patient label]</div> | <div style="text-align: center; font-weight: bold; margin-bottom: 10px;">OBSTETRIC PHARMACIST TRIAGE TOOL</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%; padding: 5px; vertical-align: top;"> <b>Admission date/time:</b> </td> <td style="width: 40%; padding: 5px; vertical-align: top;"> Triage date/time: </td> </tr> <tr> <td style="padding: 5px; vertical-align: top;"> Ward: </td> <td style="padding: 5px; vertical-align: top;"> Pharmacist: </td> </tr> </table> | <b>Admission date/time:</b> | Triage date/time: | Ward: | Pharmacist: |
| <b>Admission date/time:</b>                                                                                                                    | Triage date/time:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                   |       |             |
| Ward:                                                                                                                                          | Pharmacist:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                   |       |             |

**PATIENT DEMOGRAPHICS:**

|                                                                                                                             |                   |                   |         |            |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|---------|------------|
| Age:                                                                                                                        | Weight (booking): | Weight (current): | Parity: | Gestation: |
| <u>Allergies:</u> Penicillin <input type="checkbox"/> NSAIDs <input type="checkbox"/> Other (list) <input type="checkbox"/> |                   |                   |         |            |

**RED CRITERIA (REFER TO OBSTETRIC PHARMACIST FOR REVIEW):**

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------|----------------------------------------|------------------------------------------------------------|----------------------------------|----------------------------------|------------------------------------------|------------------------------------------|---------------------------------------------|-------------------------------------------|--|
| General                                 | Age <17 <input type="checkbox"/> Wt <50 kg <input type="checkbox"/> Wt ≥90 kg <input type="checkbox"/> Recent hospital admission <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | Substance misuse: current <input type="checkbox"/> former <input type="checkbox"/> Substance (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
| Medical conditions                      | <u>GI:</u> IBS <input type="checkbox"/> Crohn's/UC <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <u>Cardiac/Resp:</u> Hypertension (pre-existing) <input type="checkbox"/> Asthma <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <u>Neuro/Psych:</u> Epilepsy <input type="checkbox"/> Depression (pre-existing) <input type="checkbox"/> Schizophrenia <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <u>Endocrine/ Organ:</u> DM (pre-existing) <input type="checkbox"/> Thyroid <input type="checkbox"/> Renal Impairment <input type="checkbox"/> Hepatic Impairment <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <u>ID:</u> HIV/AIDS <input type="checkbox"/> Hepatitis B <input type="checkbox"/> Hepatitis C <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <u>OB:</u> Hyperemesis <input type="checkbox"/> Pre-eclampsia <input type="checkbox"/> Pregnancy Induced Hypertension <input type="checkbox"/> DM (gest) <input type="checkbox"/> Cholestasis <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <u>General:</u> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
| High-risk pharmacy (prior to admission) | Poly-pharmacy (≥ 5 medications) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | <table style="width: 100%; border: none;"> <tr> <td style="width: 15%;">Insulin <input type="checkbox"/></td> <td style="width: 15%;">Full-dose aspirin <input type="checkbox"/></td> <td style="width: 15%;">Antenatal NSAIDs excl LDA for obstetric use <input type="checkbox"/></td> <td style="width: 15%;">Warfarin/LMWH <input type="checkbox"/></td> <td style="width: 15%;">Potent Opiates excl obstetric use <input type="checkbox"/></td> <td style="width: 15%;">Lithium <input type="checkbox"/></td> </tr> <tr> <td>Digoxin <input type="checkbox"/></td> <td>Anti-epileptics <input type="checkbox"/></td> <td>Corticosteroids <input type="checkbox"/></td> <td>Immunosuppressants <input type="checkbox"/></td> <td>Anti-retrovirals <input type="checkbox"/></td> <td></td> </tr> </table> | Insulin <input type="checkbox"/>                                     | Full-dose aspirin <input type="checkbox"/>  | Antenatal NSAIDs excl LDA for obstetric use <input type="checkbox"/> | Warfarin/LMWH <input type="checkbox"/> | Potent Opiates excl obstetric use <input type="checkbox"/> | Lithium <input type="checkbox"/> | Digoxin <input type="checkbox"/> | Anti-epileptics <input type="checkbox"/> | Corticosteroids <input type="checkbox"/> | Immunosuppressants <input type="checkbox"/> | Anti-retrovirals <input type="checkbox"/> |  |
| Insulin <input type="checkbox"/>        | Full-dose aspirin <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Antenatal NSAIDs excl LDA for obstetric use <input type="checkbox"/> | Warfarin/LMWH <input type="checkbox"/>      | Potent Opiates excl obstetric use <input type="checkbox"/>           | Lithium <input type="checkbox"/>       |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
| Digoxin <input type="checkbox"/>        | Anti-epileptics <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Corticosteroids <input type="checkbox"/>                             | Immunosuppressants <input type="checkbox"/> | Anti-retrovirals <input type="checkbox"/>                            |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |
|                                         | Vancomycin/gentamicin <input type="checkbox"/> Other (list) <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                      |                                             |                                                                      |                                        |                                                            |                                  |                                  |                                          |                                          |                                             |                                           |  |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>GREEN CRITERIA</b></p> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> No need for priority review <input type="checkbox"/> </div> | <p><b>RED CRITERIA</b></p> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Higher risk issues resolved <input type="checkbox"/> F/U Mother <input type="checkbox"/> F/U Baby <input type="checkbox"/> F/U Mother &amp; baby <input type="checkbox"/> </div> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**MED RECONCILIATION / NOTES/ REASONS FOR FOLLOW UP:**

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## Appendix 8: Potential Obstetric-Specific Pharmacy Services

|                                 |                                                        |                                                                                                                                                                                                     |
|---------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inpatient only</b>           | Therapeutic drug monitoring                            | Includes aminoglycosides, vancomycin, magnesium sulfate continuous infusions, Rh immune globulin, UFH infusions, and LMWH; could include monitoring and dosing via collaborative practice protocols |
|                                 | Emergency response                                     | Attendance at high-risk deliveries, stroke alerts, postpartum hemorrhage cases, amniotic fluid embolisms, etc                                                                                       |
|                                 | Parenteral nutrition                                   | Includes monitoring and dosing via collaborative practice protocols                                                                                                                                 |
| <b>Ambulatory only</b>          | Penicillin skin testing                                | Can occur at prenatal clinic visits prior to admission for delivery                                                                                                                                 |
|                                 | Predelivery anticoagulation monitoring                 | Includes monitoring and dosing for antepartum LMWH or UFH prophylaxis/treatment via collaborative practice protocols                                                                                |
|                                 | Manufacturer assistance program coordination           | Assist patients in obtaining cost assistance for medications                                                                                                                                        |
|                                 | Long-acting injection administration                   | Administer long-acting reversible contraceptive injections (ie, medroxyprogesterone)                                                                                                                |
|                                 | High alert clinic medication coordination              | Oversee dispensing and administering of high-alert medications such as methotrexate, digoxin, and potassium chloride concentrate injections                                                         |
| <b>Inpatient and ambulatory</b> | Medication reconciliation                              | Increasingly needed due to escalating maternal comorbidities requiring medications and can assist with pregnancy planning                                                                           |
|                                 | Hypertension and diabetic medication management        | Includes monitoring and dosing via collaborative practice protocols                                                                                                                                 |
|                                 | Abortion medication use compliance                     | Protect institution, providers, and patients from legal liability by ensuring adherence to facility protocols and applicable laws                                                                   |
|                                 | Hyperemesis antiemetic management                      | Includes monitoring and dosing adjustments via collaborative practice protocols                                                                                                                     |
|                                 | Contraceptive prescribing                              | Includes prescribing via collaborative practice protocols                                                                                                                                           |
|                                 | Substance use disorder management                      | Includes assistance with methadone and buprenorphine therapy management and counseling for both marijuana and nicotine cessation                                                                    |
|                                 | Vaccination management and advocacy                    | Can occur at prenatal or inpatient encounters to ensure patients have adequate influenza, pertussis, and other recommended vaccinations                                                             |
|                                 | Antiretroviral management                              | Includes medication counselling, monitoring, and follow-up for HIV-positive patients and their newborns                                                                                             |
|                                 | Pregnancy and lactation medication list reviews        | Can occur at prepregnancy clinic visits (to assist with pregnancy planning) as well as prenatal clinic encounters and hospital admission/discharge                                                  |
|                                 | Institutional obstetric guideline/protocol development | Participate in writing and review of obstetric-related documents involving medications                                                                                                              |
|                                 | Information technology design and maintenance          | Ensure obstetric-specific medication options in EMR and infusion pump systems are appropriate and safe                                                                                              |
|                                 | Automated dispensing cabinet management                | Ensure obstetric-specific medications are appropriately stocked with sufficient quantity and safeguards                                                                                             |