

# ADMISSION HYPOTHERMIA IN VERY LOW BIRTH WEIGHT NEWBORNS AT CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

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SCHOOL OF CLINICAL MEDICINE  
WITS BIENNIAL RESEARCH DAY

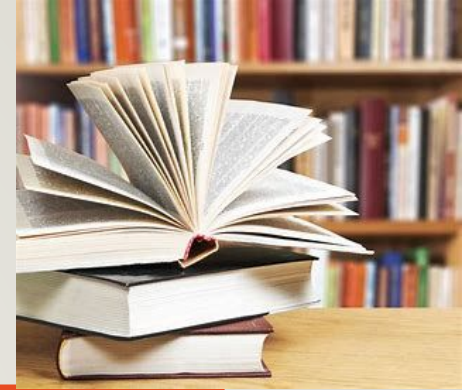
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# BACKGROUND AND RATIONALE

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- Hypothermia is associated with increased morbidity and mortality in premature newborns.
- The World Health Organisation (WHO) recognises that thermal care in the neonatal period is crucial.
- Categorisation of hypothermia according to the WHO.
- Admission hypothermia (AH) in VLBW newborns ranges between 31% and 78% globally.
- Presence of physiological risk factors for AH in premature newborns.
- Paucity of data about the prevalence of AH in VLBW newborns; particularly in Africa.
- Aim was to review AH in VLBW newborns admitted to the neonatal unit at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

# MATERIALS & METHODS (I)

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## Study design

- Retrospective, descriptive study from 1<sup>st</sup> January 2013- 31<sup>st</sup> December 2019.
- **Population:** All VLBW newborns delivered at CMJAH and transferred in within 24 hours post-delivery.
- **Exclusion criteria:** No record of initial temperature, specific congenital abnormalities.

## Setting

- CMJAH, Johannesburg.

## Database

- Secondary analysis of existing database on REDCap.

# MATERIALS & METHODS(2)



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## **Variables**

- Maternal and newborns characteristics, delivery room resuscitation intervention, post delivery complications and outcome.

## **Statistical analysis**

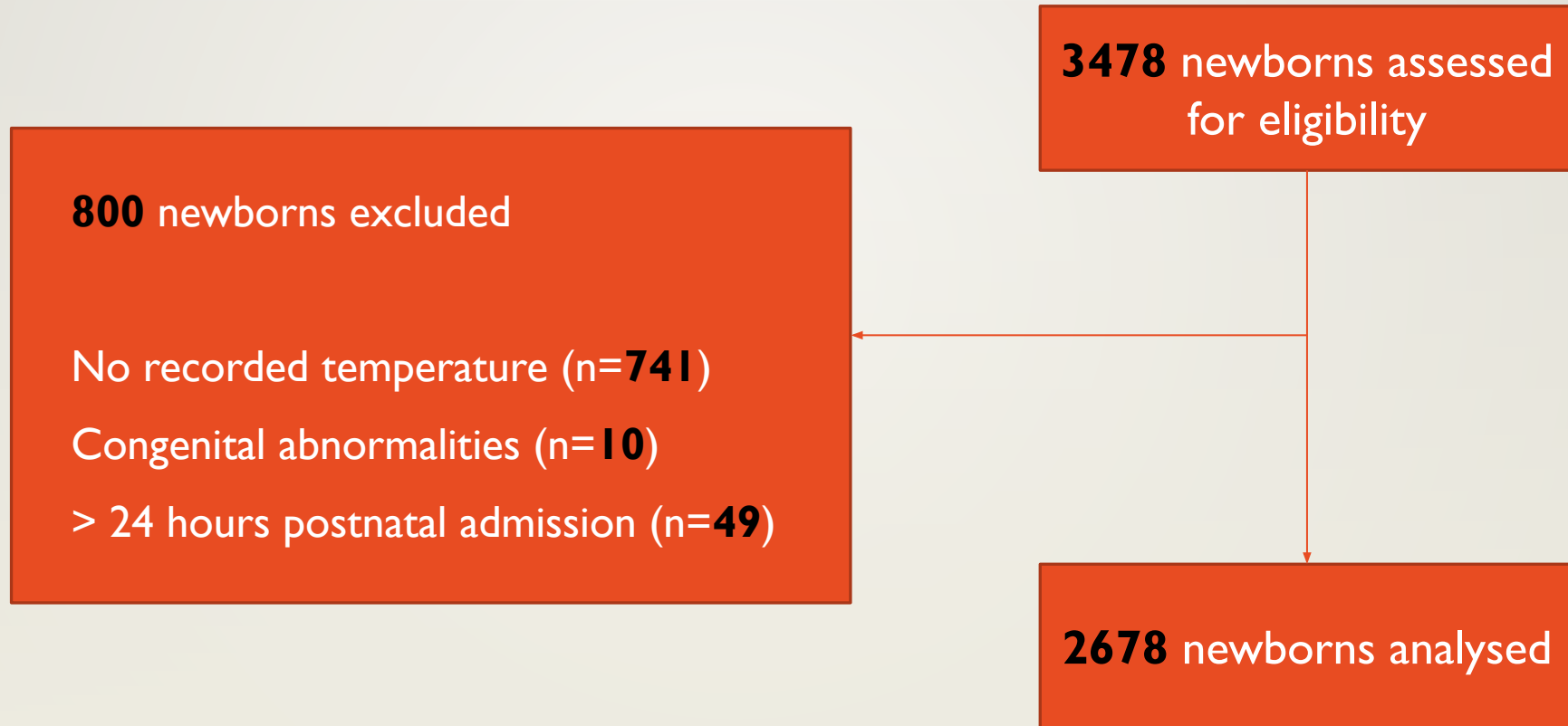
- Microsoft Excel spreadsheet for data cleaning.
- Statistical Package for the Social Sciences (SPSS) version 26 by IBM.
- Level of significance at  $p < 0.05$ .
- Logistic regression to determine associations with hypothermia.
- Multivariate analysis to explore variables that approach significance ( $p < 0.1$ ) on univariate analysis.

## **Ethics approval**

- Granted by Human Research Ethics Committee of the University of the Witwatersrand (M200651).

# SAMPLE SIZE

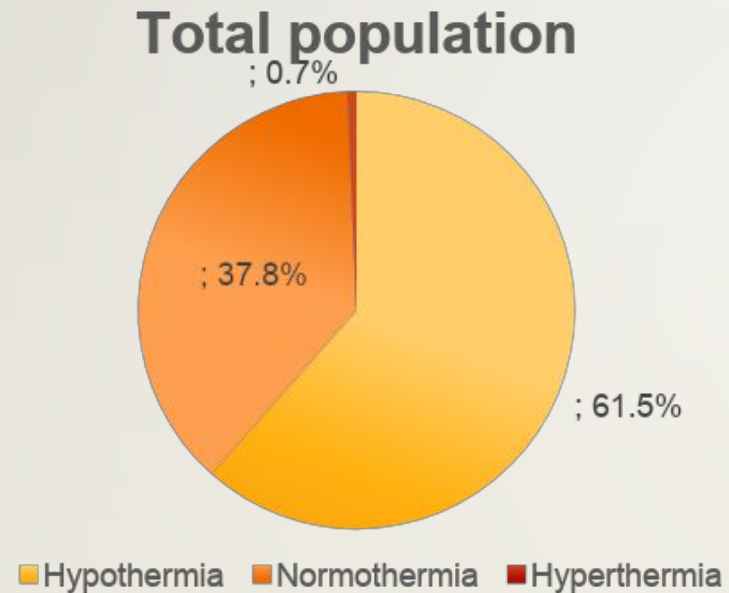
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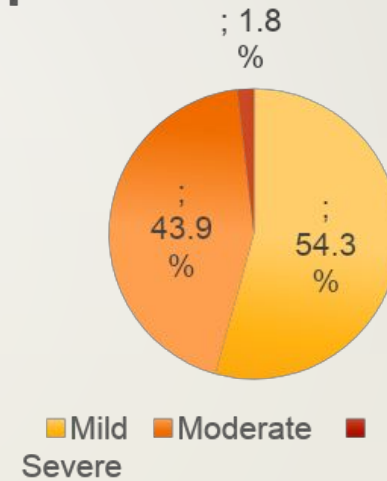
# RESULTS

## OVERALL CHARACTERISTICS OF STUDY GROUP

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### Hypothermia subgroup



# RESULTS

## I.OVERALL CHARACTERISTICS OF STUDY GROUP

Maternal characteristics	
Maternal age; mean (SD)	28 (9) years
Antenatal care	2 077 (77.6%)
Antenatal steroids	1 233 (46%)
HIV positivity	785 (30.2%)

Newborn characteristics	
Birthweight; mean (SD)	1 097 ( $\pm$ 250) g
Gestation; mean (SD)	28.9 ( $\pm$ 2.7) weeks
Inborn	2 335/2 673 (87.4%)
Female	1 422 (53.1%)
Delivery by Caesarean section	1 551/2 667 (58.1%)

Delivery room characteristics	
Required resuscitation	2 279 (85.1%)
Apgar at 1 min <7	1 197/2 498 (47.9%)
Apgar at 5 min<7	548/2 497 (21.9%)
Apgar at 10 min<7	227/ 2 331 (9.7%)

Post delivery room	
Respiratory support	2 478 (92.5%)
Metabolic acidosis (Base excess<16)	265 (9.9%)
Hypoglycaemia	384 (14.3%)

\* Population is 2678 unless otherwise specified

# RESULTS

## I. OVERALL CHARACTERISTICS OF STUDY GROUP

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Complications	
Respiratory distress syndrome	2 389 (89.2%)
Necrotising enterocolitis	207 (7.7%)
Intraventricular haemorrhage	270/1 531 (17.6%)
Early onset sepsis	64 (2.4%)
Late onset sepsis	600 (22.4%)

Outcome	
Hospital stay; median (IQR)	27 (34) days
Day 28 oxygen	655 (24.5%)
Mortality	813 (30.4%)
Mortality in delivery room	36/813 (4.4%)

\* Population is 2678 unless otherwise specified

# RESULTS

## 2. COMPARING NEWBORNS IN THE **HYPOTHERMIA** SUBGROUP TO NEWBORNS IN THE **NORMOTHERMIA** SUBGROUP

	Hypothermia (N= 1 648) <sup>ψ</sup> (61.5%)	Normothermia (N=1 012) *(37.8%)	Unadjusted Odds Ratio (95% CI)	P value
Mean admission temperature, °C(SD)	35.5(±1.1)	36.7(±0.2)		
Extremely Low Birth Weight	609 (37%)	797 (29.2%)	1.42 (1.20-1.67)	<b>&lt;0.001</b>
Male gender	749 (45.5%)	496 (49.1%)	0.87 (0.74-1.01)	0.075
Apgar at 5 min<7	361/ 1521(23.7%)	181/960 (18.9%)	1.34 (1.10-1.64)	<b>0.004</b>
Cardiac compressions	189 (11.5%)	90 (8.9%)	1.33 (1.02-1.73)	<b>0.035</b>
Metabolic acidosis	180 (10.9%)	83 (8.2%)	1.37 (1.05-1.80)	<b>0.022</b>
Respiratory distress syndrome	1 484 (90%)	888 (87.7%)	1.26 (0.99-1.62)	0.064
Early onset sepsis	32 (1.9%)	31 (3.1%)	0.63 (0.38-1.03)	0.065
Mortality	527 (32%)	(27.7%)	1.23 (1.04-1.46)	<b>0.019</b>

<sup>ψ</sup> Denominator is 1648, \* Denominator is 1012 unless otherwise specified.

# RESULTS

## 2. COMPARING NEWBORNS IN THE **HYPOTHERMIA** SUBGROUP TO NEWBORNS IN THE **NORMOTHERMIA** SUBGROUP- **LOGISTIC REGRESSION**

Variable	Adjusted Odds Ratio (95%CI)	P value
Extremely Low Birth Weight	1.37 (1.12-1.68)	0.002
Male gender	0.86 (0.73-1.01)	0.07
Apgar at 5 min<7	1.16 (0.91-1.49)	0.24
Cardiac compressions	1.14 (0.84-1.55)	0.41
Metabolic acidosis	1.07 (0.79-1.46)	0.66
Respiratory distress syndrome	1.21 (0.94-1.57)	0.15
Early onset sepsis	0.51 (0.30-0.88)	0.02
Mortality	0.95 (0.76-1.19)	0.67

Extremely low Birth  
Weight

Early onset sepsis

# RESULTS

## 3. COMPARING NEWBORNS IN THE **MODERATE TO SEVERE** HYPOTHERMIA SUBGROUP TO NEWBORNS IN THE **MILD HYPOTHERMIA** SUBGROUP

	Moderate/ Severe Hypothermia (753/1 648) (45.7%) $\Psi$	Mild hypothermia (895/1 648) (54.3%)*	Unadjusted odds ratio (95% CI)	P value
Admission Temperature, mean (SD)	34.8 (1.3) ° C	36.2 (0.2) ° C		
Antenatal care	543 (72.1%)	723 (80.8%)	0.62 (0.49-0.77)	<0.001
Antenatal steroids	282 (37.5%)	461 (51.5%)	0.56 (0.46-0.69)	<0.001
Newborn with ELBW	313 (41.6%)	296 (33.1%)	1.44 (1.18-1.76)	<0.001
Newborn with gestation < 30 weeks	497/744 (66.8%)	527/890 (59.2%)	1.39 (1.13-1.70)	0.002
Delivered by Caesarean section	378 (50.3%)	560 (62.7%)	0.60 (0.50-0.73)	<0.001
Inborn	615 (81.8%)	820 (91.9%)	0.39 (0.29-0.53)	<0.001

$\Psi$  Denominator is 753, \* Denominator is 895 unless otherwise specified.

# RESULTS

## 3. COMPARING NEWBORNS IN THE **MODERATE TO SEVERE** HYPOTHERMIA SUBGROUP TO NEWBORNS IN THE **MILD HYPOTHERMIA** SUBGROUP

	Moderate/ Severe Hypothermia (753/1 648) (45.7%) $\Psi$	Mild hypothermia (895/1 648) (54.3%) *	Unadjusted odds ratio (95% CI)	P value
Apgar score at 5 min<7	191/666 (28.7%)	170/855 (19.9%)	1.62 (1.28-2.06)	<0.001
Apgar score at 10 min<7	87/618 (14.1%)	61/810 (7.5%)	2.01 (1.42-2.84)	<0.001
Cardiac compressions	107 (14.2%)	82 (9.2%)	1.64 (1.21-2.23)	0.001
Intubation in the delivery room	27 (3.6%)	13 (1.5%)	2.52 (1.29-4.93)	0.005
Metabolic acidosis	105 (13.9%)	75 (8.4%)	1.77 (1.30-2.42)	<0.001
Intraventricular haemorrhage	85/411 (20.7%)	76/507 (15%)	1.48 (1.05-2.08)	0.024
Late onset sepsis	146 (19.4%)	211 (23.6%)	0.78 (0.62-0.99)	0.04
Length of stay, median (IQR)	25(39) days	27(32) days	1.005 (1.002-1.009)	0.006
Mortality	287 (38.1%)	240 (26.8%)	1.68 (1.36-2.07)	<0.001
Mortality in the delivery room	20/287 (7%)	5/240 (2.1%)	3.52 (1.30-9.53)	0.009

$\Psi$  Denominator is 753, \* Denominator is 895 unless otherwise specified.

# RESULTS

## 3. COMPARING NEWBORNS IN THE **MODERATE TO SEVERE** HYPOTHERMIA SUBGROUP TO NEWBORNS IN THE **MILD HYPOTHERMIA** SUBGROUP- **LOGISTIC REGRESSION**

Variable	Adjusted OR (95%CI)	P value
Antenatal care	1.25 (0.83-1.87)	0.29
Antenatal steroids	<b>0.66 (0.48-0.89)</b>	<b>0.007</b>
ELBW	1.00 (0.71-1.40)	0.99
Born via C/S	0.75 (0.64-1.04)	0.09
Inborn	1.09 (0.55-2.18)	0.80
Apgar at 5 min<7	1.19 (0.75-1.87)	0.46
Apgar at 10 min<7	1.14 (0.58-2.24)	0.71

Variable	Adjusted OR (95%CI)	P value
Cardiac compressions	0.94 (0.55-1.62)	0.83
Intubation (delivery room)	1.47 (0.47-4.57)	0.51
Metabolic acidosis	1.64 (0.95-2.84)	0.08
Intraventricular Haemorrhage	1.37 (0.92-2.04)	0.12
Late onset sepsis	0.92 (0.65-1.31)	0.64
Length of stay	1.00 (0.99-1.01)	0.66
Mortality	0.76 (0.46-1.26)	0.29

Antenatal steroids

# DISCUSSION

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- 61.5% of VLBW newborns with admission hypothermia.

## **Comparing the hypothermia subgroup to the normothermia subgroup**

- ELBW: Association with hypothermia > normothermia (aOR 1.37).
- Early onset sepsis: Association with hypothermia < normothermia (aOR 0.51).
- No association with mode of delivery or place of birth.

# DISCUSSION

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**Comparing the moderate to severe hypothermia subgroup to the mild hypothermia subgroup**

Use of antenatal steroids as protective factor: Association with moderate/ severe hypothermia < mild hypothermia (aOR 0.66).



# LIMITATIONS

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- Retrospective nature of the study.
- 20% of newborns did not have their initial temperature recorded.
- Uncertain about exact time of the first temperature postnatally.
- Worth knowing the room temperature.
- Site of temperature recorded.

# CONCLUSIONS

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- High prevalence of AH in VLBW newborns.
- Association of AH with lower birthweight but inverse association with early onset sepsis.
- Antenatal steroids associated with mild hypothermia > moderate to severe hypothermia.

# RECOMMENDATIONS

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- Importance of thermoprotective factors.
- Widespread consensus in using WHO criteria of hypothermia.
- Quality improvement programmes.
- Relation between number of doses of antenatal steroids and degree of hypothermia.



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# THANK YOU

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- Acknowledgements

- Any questions?



**“If a definition of life were required, it must be most clearly on that capacity by which the animal preserves its proper heat under the various degrees of temperature of the medium in which it lives... a few degrees of increase or diminution of the heat of the system, produces disease and death.”**

James Currie 1808