

Warming up for temperature control of vulnerable preterm infants

A mixed method study about the applied interventions in case of a perceived hypo- or hyperthermia in preterm infants < 30 weeks gestational age

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Introduction

Temperature regulation in preterm infants, especially below 30 weeks gestational age (GA), is a risk factor for complications, caused by fluctuations in temperature (1). Increased efforts of the neonatal nurses will be necessary to prevent hypothermia as well as hyperthermia in preterm infants.

The immature thermoregulatory mechanism and a relatively large body surface causes problems in temperature regulation in preterm infants (2). The incapacity of shivering, the lower metabolic rate, the less developed peripheral vasoconstriction and the high evaporative heat losses makes clinical temperature management difficult in infants below 30 weeks GA and regulation of temperature becomes more complex if the weight of the infant decreases (1). Abnormal temperatures are associated with increased morbidity and mortality (3). Adjusted analyses revealed that mortality and late-onset sepsis were increased by 28% and 11%, respectively, per 1°C decrease in temperature (4). Physiological problems as peripheral oedema, metabolic acidosis, haemorrhagic pulmonary oedema may occur. Hypothermia was also associated with higher risk of intraventricular haemorrhage (IVH) in very low birth weight infants (5). Complications during rewarming may present in symptoms as hypotension, hypoglycaemia, overtreatment of metabolic acidosis, necrotising enterocolitis (1). Besides hypothermia, an increased temperature above 38 degrees Celsius, can also have devastating consequences to the preterm infant. Sweating in response to a warm environment is absent in infants below 36 weeks GA and leads to a poor defence against overheating. A heat-stroke (>40 °C) may lead to cellular degeneration that occurs in all organs (especially the cerebral cortex and cerebellar regions) and may result in severe neurological deficits (6). To prevent these complications, caused by temperature fluctuations, accurate temperature monitoring is essential for this vulnerable population (7).

Literature speaks about temperature thresholds of 36.0 and 38.0 °C, but these are not specific for preterm infants (8). At the University Medical Centre (UMC) under study, continuous skin measurements and additionally rectal measurements are taken (when needed by the nurse). If ranges are set, an alarm sounds from the monitor when temperatures of the infant are beyond ranges. Besides monitoring, nurses play an important role in responding to perceived hypothermia or hyperthermia. To prevent hypo- and hyperthermia, different interventions are currently used, like heating up or lowering the temperature of the incubator and covering or removing blankets. Optional interventions to prevent hypo- and hyperthermia just after birth are already discussed in different studies (9-

15), but literature about interventions applicable at a Neonatal Intensive Care Unit (NICU) is lacking.

Problem statement

At the NICU under study, no unequivocal protocol is used in cases of perceived hypo- or hyperthermia and it is unknown what current practices of nurses are regarding temperature regulation. Especially because the minimum age in which treatment of an infant will be started after birth is decreased in The Netherlands to 24 weeks GA in 2010, more attention is needed for problems like hypo- and hyperthermia, because younger infants are more vulnerable.

Aim

The aim of this study was to clarify the current operations concerning hypo- and hyperthermia of preterm neonates below 30 weeks GA at the NICU of a UMC in the Netherlands. Insight in the current operations provides information, which is a first step in developing an evidence based guideline in thermoregulation of this specific population.

Research questions

- What is the incidence of hypo- and hyperthermia over a year in preterm infants below 30 weeks GA?
- Which interventions are applied by NICU nurses in case of a perceived hypo- or hyperthermia in preterm neonates below 30 weeks GA and which arguments do nurses mention to substantiate their way of handling?

Method

This study follows a mixed method design, in which quantitative data is embedded in qualitative data and therefore an embedded design is best appropriate (16). Data was collected sequential, where quantitative data was collected prior to qualitative data. The emphasis is at the qualitative data, because the focus of this study is at the way nurses handle, in which quantitative data is supporting.

For the quantitative part, retrospective observational data, which consist of registered body temperatures of the preterm infants below 30 weeks, collected over a year, was used as starting-point for the qualitative part of this study.

After interviewing five nurses, saturation of the data was reached. Because this study has an explorative nature, aspects of the grounded theory were used for qualitative data collection, namely sensitizing concepts and constant comparison (17,18). By using semi-

structured interviews, personal experiences and background information about the personal way of handling could be gathered.

Study population

The eligible population of the quantitative data collection consist of preterm neonates below 30 weeks GA, inborn at the selected UMC and admitted to the NICU in 2013. Infants were included by a consecutive sample (19).

The eligible population for the qualitative data collection consisted of neonatology nurses of the selected UMC. Nurses were selected by purposive sampling. To get a heterogeneous sample, aspects as age, work experience, education and background were taken into account (table 1) (20). Trainee and temporarily employees were excluded because experience of working at the NICU was needed, to answer the interview questions. Nurses were verbally asked for participation and received an email with supplementary information about the study.

[Insert table 1]

Outcome parameters (table 2)

In both, quantitative and qualitative measurements, demographic data was gathered to foresee in relevant contextual information.

For the quantitative part of the study, the incidence of hypo- and hyperthermia was determined in the first week after admission on the NICU. By analysing data from the patient data management system (PDMS), also the number of adaptations concerning the temperature of the incubator was collected, because this information is additional evidence to the qualitative data.

Qualitative data consists of nine parameters, which were included in a semi-structured interview. "The threshold for temperature" was added because no values were found in literature for this target group and it was unknown which thresholds regarding temperature nurses used. For the development of a future guideline, arguments of nurses for their current way of handling can be used and therefore nurses were asked for their 'motivation for their way of handling, in case of a perceived hypo- or hyperthermia' and 'the use of the alarms'.

[Insert table 2]

Procedures

Quantitative data was gathered from the first week of the infants' life, because in this week the infants are most vulnerable and the temperature regulation system of the infant is less developed (1). At the NICU under study no written guideline exist regarding temperature threshold values. It was discussed with one of the senior staff nurses that nurses should intervene when temperatures are not between 36.5 and 37.8 °C, so these threshold values were operated in this study. For counting the incidence of hypo- and hyperthermia, only validated rectal measurements were analysed from the PDMS, because these are taken manual and expected to be valid, instead of skin measurements, which are depending on a right located probe. If rectal temperature measurements were out of range, continues skin temperatures were analysed to determine the length of the perceived hypo- or hyperthermia in units per 30 minutes.

Interviews took place in February 2014 and March 2014 . The interviews were held face-to-face and lasted half an hour on average. The interviews were audiotaped and transcribed verbatim for analysis.

Quantitative data was analysed by using SPSS software for Windows, version 20 (SPSS, Chicago, IL). Descriptive statistics were used to report data. Partial correlation was computed to show correlation between the characteristic 'gestational age'/'birth weight' and the performance of hypo- and hyperthermia.

For data management of the interviews, the software program NVivo10[®] software was used. Data was analysed using the analytical steps described by Boeije (17) and the QUAGOL guide (21). Data was coded by using three types of coding: open coding, axial coding and selective coding (22). After thorough reading of the transcripts, impressions were discussed by the first and last author, which resulted in a code tree. Then all transcripts were reread by the first author and subsequently common concepts were identified. A story-line in response to the research question was developed by integrating all concepts into categories and themes. The essence of the concepts was described using quotes associated with the different themes.

Quality aspects

Content validity of the research questions was first tested by three peer researchers following the steps Lynn (23) describes and using the content validity index (CVI) (24). Aspects of improvement were worked out before the interviews were started.

To ensure inter-rater reliability, coding the transcripts of the interviews was conducted by two researchers (19). Differences were discussed until agreement was established.

Ethical considerations

The study was approved by the local ethical committee and it was confirmed that the Medical Research Involving Human Subject Act does not apply to this study (reference number WAG/om/14/001078). Privacy of patients and participants was conserved by using unique identification codes to avoid identification. The key to the code was safeguarded by the investigator and supervisor. Handling of data occurred in accordance with the Dutch Personal Data Protection Act. Written informed consent was obtained from all participating nurses and infants were included according to the opt-out method.

Results

Quantitative part (table 3,4)

Incidence of hypo- and hyperthermia

The original data set included 113 infants. Of 5 infants medical data was not assessable and one infant died short after birth and therefore no data was registered. Of the remaining 107 infants the incidences of hypo- and hyperthermia were counted and showed in table 4 expressed in numbers and percentages. Six infants were admitted shorter than the observation time of one week and were not enrolled in calculating correlations between birth weight/GA and the incidence of hypo- and hyperthermia, because this would cause observation bias (19). Rectal measurements of the remaining 101 infants were taken 6- 34 times (median: 26) in the first week postnatal. Ranges of the number of measurements under 36.5 °C were 0 to 7 times (median: 3) and of measurements above 37.8 °C 0 to 2 times (median: 0) (figure 1).

[Insert figure 1]

A correlation of $r = .565$ ($df = 99$, $p .000$) was found between birth weight of the infant and the number of rectal measurements, taken within the first week postnatal (figure 2). Also correlation between GA and the number of rectal measurements was found to be significant, namely: $r = .452$ ($df = 99$, $p .000$) (figure 3).

Further only the correlation between birth weight and the number of measurements under 36.5 °C and the duration of the existed hypothermia was significant ($p .001$ and $p .025$).

[Insert table 3]

[Insert table 4]

[Insert figure 2]

[Insert figure 3]

Qualitative part

(Quotes are represented in table 5)

Thresholds regarding temperature management

Nurses employ different kind of thresholds regarding temperature. The thresholds used in practice were founded at their personal experience and based on their education. Besides the fact that all nurses assign the importance to keep temperature as stable as possible, ignorance was noticed towards specific thresholds for preterm infants.

Interventions hypothermia

The intervention that was applied most in case of a low temperature, was covering the body and head of infant with a small blanket. The reason for applying this intervention is because, blankets can be removed easily and it is less disturbing the infant. For instance, if the doors of the incubator will be opened for feeding, the infant is covered and disturbed minimal. Raising the temperature of the incubator by steps of 0.2 - 0.4 °C would be the second step in intervening for most nurses. Interventions applicable to raise an infant 's temperature when nursing the infant, were putting a hat to the infant 's head and turning the infant at the prone position, which leads to less heat loss. Using a hat was not preferable for all nurses because the head also could be easily covered with a small blanket and when infants are on nasal continuous positive airway pressure (nCPAP), they already wear a hat. Only if the temperature of the infant is decreased significantly, a combination of interventions would be used.

Interventions hyperthermia

Two days after birth, according to standard procedures, the temperature of the incubator can be lowered significantly. Most nurses choose to take away blankets or hats first, because it would be more effective than lowering the temperature of the incubator. The argument was that taking away blankets causes airflow around the infant. If the temperature of the incubator is lowered while the infant is still wrapped in blankets, the infant still won 't loose his warmth. Secondly they would lower the temperature of the incubator. Sometimes nurses change the position of the infant from the prone to the supine position or the side. However it was said that this is not preferable, because it disturbs the infant. In case of a very high temperature nurses would combine interventions.

Context of temperature

After perceiving an abnormal temperature, nurses first look at the cause of this abnormality, like for example an infection or restlessness of the infant. This cause first will be dealt with.

Sometimes nurses wait 30 to 60 minutes and observe the temperature trend before responding directly, to prevent temperature fluctuations, but also an abnormal increase or decrease of temperature, in a short time, can just be a trigger for intervening. Eventually earlier events are taken into account. Changing the position of the infant, the use of non-warmed oxygen, open doors of the incubator, kangarooing and interventions like inserting an intravenous line, can be reasons not to intervene or just to intervene at time, as a precaution. By taking little steps and taking into account the context of the temperature, fluctuations are avoided as much as possible. All nurses mention to be especially careful in preterm infants, because they are more vulnerable and temperature is fluctuating more.

To all nurses the choices for the way of handling were mostly based on their own intuition and experience. Other influencing factors that were mentioned are education, knowledge of the infant which arises after birth and physical signs like a cold skin, heart rate and frequency of breathing.

Less disturbing the infant

Nurses base a lot of actions on their knowledge and intuition but next to this, disturbing the infant less as possible, was mentioned often. Nurses try to avoid invasive interventions as much as possible, like turning the infant or taking of cloths. Mostly these interventions are only applied at the moment of nursing the infant to maintain rest for the infant.

Rectal and skin measurements

Most nurses trust the skin temperature measurements, but only if the probe is at the right position, namely into the diaper against the skin of the infant. Nurses often apply a rectal measurement in case of a continuing abnormal temperature and at the beginning of a shift to get a reference value, however this is done also less as possible, to prevent disturbing the infant. There seems to be discord regarding the use of too many rectal measurements caused by a lack of trust regarding skin measurements. Two nurses sometimes use axillar measurements instead of rectal measurements because this is less disturbing.

Use of alarms

After intervening on hypo- or hyperthermia, nurses observe temperature by skin measurements. The ranges of the alarms of the monitor are set narrow and are used to get a sign if temperature drops or decreases more. With stable temperatures, four nurses don't

use the alarms, because the sound can be annoying and the use of it is not needed because normally temperatures are checked every hour. One of the nurses always uses the alarms because this gives a feeling of control.

[Insert table 5]

Discussion

Qualitative data shows that nurses practice differently regarding temperature regulation, but fluctuations in temperature are avoided as much as possible and preterm infants are of special concern. The intervention that was mentioned most in case of a perceived hypothermia, was first adding small blankets around the infant and secondly raising the temperature of the incubator. In case of a perceived hyperthermia, nurses mostly first choose to take away blankets of the infant and then lower the temperature of the incubator. In both cases nurses substantiate their way of handling with different arguments, but the factor 'less disturbing the infant' is leading, especially in very small preterm infants. Evidence suggests that the NICU environment with bright lights, noise, frequent handling, and "noxious" procedures magnifies negative outcomes for preterm infants, whose central nervous systems are not yet developed to adapt to extreme environmental stimuli, so handling needs to be minimized as much as possible (25,26). This was supported by quantitative data, which shows that with the increase of birth weight and GA, also the number of rectal measurements increased significantly. Rectal measurement are not preferable in small preterm infants because of contra-indications like discomfort, potential increase in blood pressure, intracranial pressure, decrease in PaO₂ and vagal response (2,27). Nevertheless some nurses in this study do not rely on skin measurements. Literature just shows that skin measurements are suitable and reliable in preterm infants, if the probe is placed in the right position by the way of 'zero heat flow' and the infant was placed in an convective incubator (27,28). Jirapeat et al. (29) advised to apply an extra axillary or rectal measurement before corrective measures are taken.

Despite extra attention of nurses towards small preterm infants, birth weight was correlated with hypothermia and only 10% of the infants did not suffer hypothermia in the first week postnatal, which can be explained by the immature temperature regulation system of low birth weight infants (1). High (but no significant ($p .081$ and $p .094$)) correlations between the number of measurements above 37.8 °C regarding GA and birth weight, show that with an increase of birth weight and GA, the number of high temperatures also increased. Nurses

may pay less attention towards older and bigger infants, but nurses also may have a wrong vision of what is suitable practice for these infants.

Different thresholds regarding temperature are operated by nurses in this study. Controversy about the definition of hypo and hyperthermia was also found in literature (14,30). It should be questioned whether strict thresholds should be operated in preterm infants because the amount of influencing factors that play a role in determining a reasonable temperature for every individual infant. Also in choosing an intervention, different aspects were taken into account, but choices differed between infants and were not only based on true facts. The aspect of intuition and the insight of the nurse should not be underestimated. This subjective reasoning, which is mostly based on experience and education, can be debatable in practicing at the intensive care of this vulnerable population (31). Applying standardized models for decision making, like 'concept mapping', may help nurses in clinical reasoning (32-34).

To our knowledge, no earlier research was published regarding temperature regulation at the NICU in this vulnerable population. The fact that quantitative data was followed up by interviews, gave meaning to the phenomenon temperature regulation and is a strength of this study.

Literature (27,29), but also a nurse in this study, mentioned the possible small difference in temperature between rectal and skin measurements in preterm infants. In this study it was also seen that some rectal measurements were abnormal when skin measurements were normal at that time. The researcher dealt with this, by noting half an hour for the period of this abnormal temperature, but this was a weakness of this study. During the analysing process it was noticed that nurses do not always register a rectal measured value in PDMS immediate after measuring and that they often validate an incorrect value, which may have caused performance bias. It also has to be taken into account that adapting the temperature of the incubator was not registered in PDMS by every nurse and also other interventions in temperature regulation were not registered at all.

Conclusion

No strict guidelines are operated regarding temperature regulation in preterm infants at the NICU under study. Despite the significant correlation between birth weight and hypothermia ($p < .05$), extra attention was paid regarding preterm infants by the nurses. Different interventions were applied in case of a perceived hypo- or hyperthermia. Choices for interventions were based on a variety of factors like the trend of temperature, situation of the

infant and disturbing the infant less as possible. In this the intuition of the nurse plays a major role in decision making.

Recommendations

Further research needs to be done regarding the effectiveness of different interventions that can be applied in case of a perceived hypo- or hyperthermia, which can be used for development of a guideline and standardization of clinical decision making regarding temperature regulation. Especially the population of infants under 30 weeks GA needs attention because of the higher risk of developing hypothermia and complications as a consequence of temperature fluctuations and therefore consequent observation and registration by the neonatal nurse is of substantial importance.

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Table 1: Demographic data nurses

Participant*	1	2	3	4	5
Age (years)	30	29	26	32	50
Education	- Registered nurse with Bachelor of Nursing Degree	- Bachelor of nursing - 1 year master in health sciences	- Registered nurse with Bachelor of Nursing Degree	- Registered nurse without Bachelor of Nursing Degree	- Registered nurse without Bachelor of Nursing Degree
Work experience NICU (years)	7	2	1	4	14
Other work experience	-	- 2 years general nurse - 3 years specialisation children and maternity	- 3 years neonatal high care and medium care	- 10 years as a specialized nurse in oncology, children and maternity	- 10 years as specialized nurse in children care

* All participants were female

Table 2: Quantitative parameters and topics used for the qualitative part of the study

	Quantitative part	Qualitative part
Demographic data	<ul style="list-style-type: none"> - Gender - Gestational age (weeks) - Birth weight (grams) 	<ul style="list-style-type: none"> - Gender - Age - Education - Work experience at NICU* - Other work experience
Parameters	<p>(Data gathered from first week after birth)</p> <ul style="list-style-type: none"> - Number of valid rectal measurements - Number of measurements under 36.5 °C - Length of period under 36.5 °C in hours - Number of raising the temperature of the incubator - Number of measurements above 37.8 °C - Length of period above 37.8 °C in hours - Number of lowering the temperature of the incubator - Days of admission (if shorter than 7 days) 	<p><i>First question: Between which threshold values do you want to keep temperatures of a preterm infant under 30 weeks GA?</i></p> <ul style="list-style-type: none"> - Thresholds of temperature for a preterm neonate under 30 weeks gestational age - Ranges in temperature for taking action - Kind of actions in case of a perceived hypothermia - Motivation for the way of handling in case of a perceived hypothermia - Kind of actions in case of a perceived hyperthermia - Motivation for the way of handling in case of a perceived hyperthermia - Use of the alarms of the monitor regarding temperature - Ranges of setting the alarms - Reasons for changing the set alarms

* Neonatal Intensive Care Unit

Table 3: Clinical characteristics infants

	No.	Mean	Total
Male/Female	59/48		107
Gestational Age (weeks)		27 + 2 days	
23-26	23		
26-28	43		
28-30	41		
Birth weight (grams)		998.98	
< 750	18		
750-1000	36		
> 1000	53		

Table 4: Outcomes quantitative part, incidence of hypo- and hyperthermia

Variable	Total	Percentage	Partial correlation* Birth weight	Partial correlation* GA
Participants	n: 107		n: 101**	n: 101**
Number of rectal measurements	2575			
Number of measurements < 36.5 °C	299	12 %	$r = -.336$ ($df = 98, p .001$)	$r = -.110$ ($df = 98, p .274$)
Duration hypothermia (hours)	613.5		$r = -.224$ ($df = 98, p .025$)	$r = -.014$ ($df = 98, p .889$)
Number of raising temperature incubator	198	66 % (of all measurements < 36.5 °C)		
Number of measurements > 37,8 °C	28	1 %	$r = .175$ ($df = 98, p .081$)	$r = .169$ ($df = 98, p .094$)
Duration hyperthermia (hours)	74.5		$r = .109$ ($df = 98, p .281$)	$r = .040$ ($df = 98, p .691$)
Number of lowering temperature incubator	23	82 % (of all measurements > 37.8 °C)		

* Corrected for variable: 'Number of rectal measurements'

** In calculating correlations, 6 infants were excluded because they were not admitted at the NICU for at least one week, namely 2,4 or 5 days.

Table 5: Illustrative quotes

<p>Thresholds regarding temperature management</p> <p><i>“I think around 37 degrees [Celsius]. Normally you would aim for 36.8 to 37.4, but for the very little ones I aim for a stable temperature of around 37 degrees [Celsius]. Not too warm, not too cold, but just right” (4).</i></p> <p><i>“But personally I think 37.5 degrees is a temperature I would definitely do something with” (3).</i></p> <p><i>“N¹: Well the aim is usually between 36.8 and ... R²: Hmmm N¹: ... and 37.3. Personally I think 37,3 is quite high...(3)”.</i></p> <p><i>“... no I can't say that there are certain standard degrees I use for a premature and other certain standard degrees for early premature children, or something” (4).</i></p> <p><i>“But at the moment I am not sure whether, for instance, there is a lower threshold for those under 30 weeks than for those of 30 weeks and older” (3).</i></p>	<p>Less disturbing the infant</p> <p><i>“Yes. And with the incubator, yes, that is just non-invasive as you can just let the child lie and you... ehh, you just play with the temperature of the incubator and then you just look at the effect it has” (4).</i></p>
<p>Interventions hypothermia</p> <p><i>“To cover them up more is no use, because if you increase the temperature in the incubator and you cover the child up, the warmth will not reach the child. So often I don't do that” (4).</i></p> <p><i>“N¹: I am not going to disturb a child for that. If a child is lying on his side, and his temperature is a little bit too low I usually choose to increase the temperature in the incubator, than to wake him up and turn him. R²: Yes, OK. N¹: I don't really think... because I can use another intervention, I think I shouldn't disturb a child for that, you know” (4).</i></p>	<p>Rectal and skin measurements</p> <p><i>“... So often when a child has an actual reason to cool off, because I think that is what we are talking about, then euhm, then you can take his temperature at the time because he is awake and the incubator has been open and light anyway, among other things, to know your baseline temperature. But when I... then I hoop not to have to disturb again for the coming six hours, you know” (1).</i></p>
<p>Interventions hyperthermia</p> <p><i>“I prefer to lower the temperature of the incubator, but I know that when the child is that warm and warmly tucked in than it doesn't have much effect. Because then it has much more effect to take the blanket away, so he can lose the warmth/heat. Because if you keep it in, the heat/warmth, you can use the incubator, but then you have to open it all the way for it to have an effect, so then you take away the blankets” (1).</i></p>	<p>Use of alarms</p> <p><i>“And it is not something that immediately just... look... vomiting, or an apnoea, that is something you have to act on immediately. And I think that temperature... yeah... you check it every hour. So when it comes to that... No... I don't set alarms” (4).</i></p>

<p>Context of temperature</p> <p><i>“... so it doesn’t depend on the value but rather in the time in which the value changes, I think” (2).</i></p> <p><i>“N¹: There are some children who at one point have a high temperature and the next they have a low temperature.</i> <i>R²: Yes</i> <i>N¹: ... and sometimes it seems... it is due to the kind of child, so to speak. When it is very premature and because of that it is a bit up and down, so to speak....</i> <i>R²: what is your response to that? Do you quickly adapt?</i> <i>N¹: I do pay attention. I pay attention more” (4).</i></p> <p><i>N¹: “It’s experience, it’s a bit... and also knowing the infant, because not every infant reacts as quick as any other infant. So euhm, you know, you learn from education that when an peripheral infusion is inserted and the doors of the incubator are open, the infants temperature will drop. That are facts you know, but you don ‘t know how much the temperature will drop.</i> <i>R²: Yes, okey..</i> <i>N¹... Therefore you need to know the infant. The age, and if the infant was just born and is still wet, then temperature drops more quickly.</i> <i>R²: Hmmm...</i> <i>N¹: If the infant is older and bigger or thinner, well.. that... you learn to look at that kind of aspects, but it’s mostly based on your own feeling” (1).</i></p>	

* The number of the participant who quoted is placed in brackets

¹ Nurse

² Researcher

If no R or N was used, the sentence was quoted by a nurse

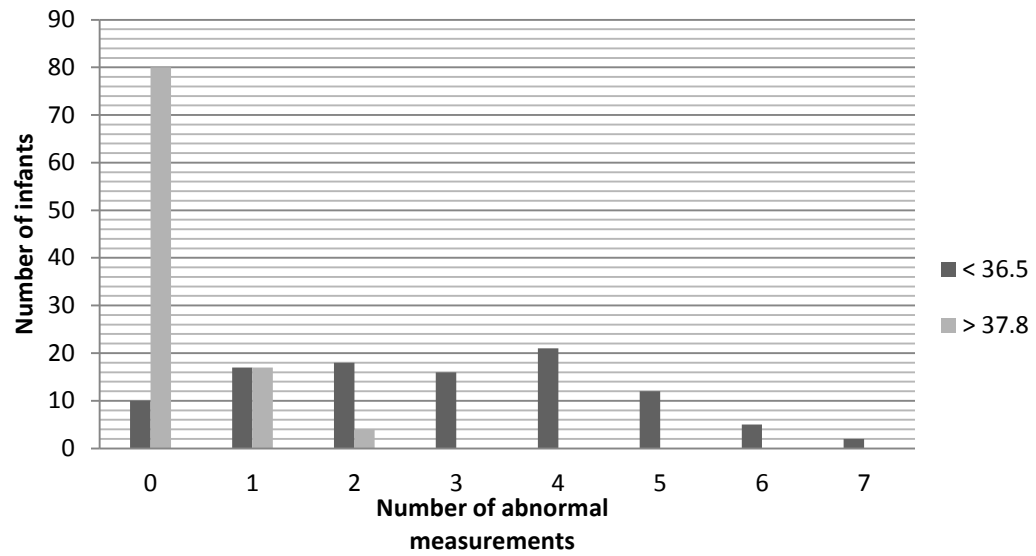


Figure 1: Number of rectal measurements < 36.5 °C and > 37.8 °C in the first week postnatal (n: 101)

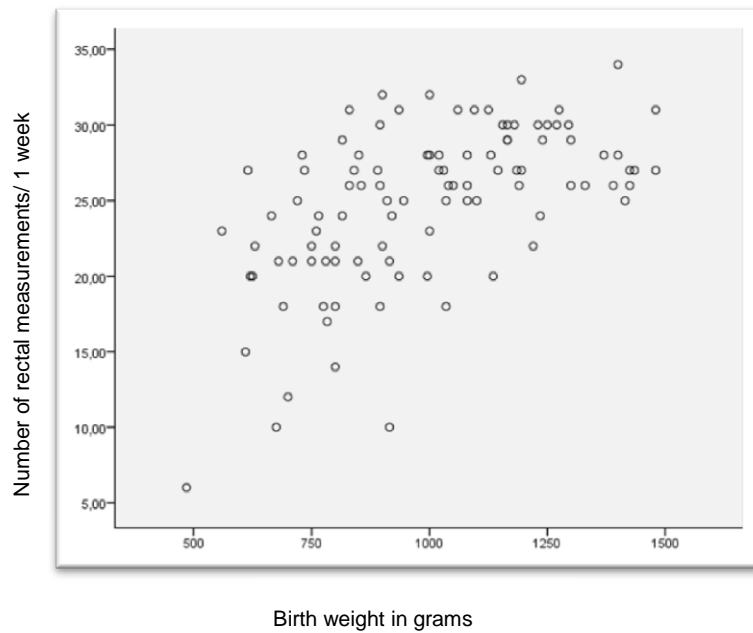


Figure 2 : Scatterplot of correlation (birth weight/number of rectal measurements)

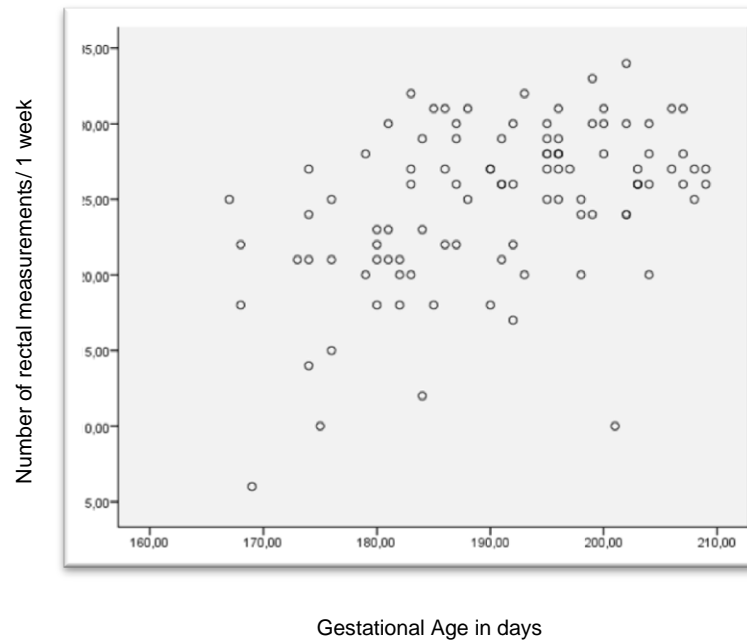


Figure 3: Scatterplot of correlation (GA/number of rectal measurements)

Dutch summary/ Nederlandse samenvatting

Titel: Opwarmen voor de temperatuur bewaking van kwetsbare preterme neonaten.

Introductie: Temperatuurregulatie bij preterme neonaten, met name onder de 30 weken zwangerschapsduur, is een risicofactor voor het oplopen van complicaties, veroorzaakt door temperatuurf fluctuaties. Literatuur over de door verpleegkundigen toe te passen interventies bij temperatuurf fluctuaties mist en ook bestaat er op de neonatologie intensive care unit (NICU) uit deze studie, geen protocol.

Doel: Het doel van deze studie was het in kaart brengen van de huidige werkwijze op de NICU omtrent temperatuurregulatie van preterme neonaten onder de 30 weken zwangerschapsduur.

Onderzoeksvragen: - Wat is de incidentie van hypo- en hyperthermie gemeten over een jaar bij preterme neonaten onder de 30 weken zwangerschapsduur?

- Welke interventies worden toegepast door NICU verpleegkundigen in het geval van een geconstateerde hypo- of hyperthermie bij preterme neonaten onder de 30 weken zwangerschapsduur en welke argumenten benoemen verpleegkundigen voor hun handelswijze?

Methode: Om deze onderzoeksvragen te beantwoorden werd een mixed- method onderzoek uitgevoerd op de NICU van een Universitair Medisch Centrum (UMC) in Nederland. Kwantitatieve data werd verzameld uit patiëntendossiers en kwalitatieve data door het afnemen van semigestructureerde interviews. De studiepopulatie bestond uit 107 preterme neonaten onder de 30 weken zwangerschapsduur, geboren in 2013 in het UMC en vijf vaste NICU verpleegkundigen.

Resultaten: Een significante correlatie werd gevonden tussen geboortegewicht en de aanwezigheid van hypothermie ($p < .05$). Verpleegkundigen benoemden verschillende toegepaste interventies, maar hadden allen extra aandacht voor de kleinste neonaten. Argumenten voor hun handelswijzen waren voornamelijk gebaseerd op intuïtie, maar hierin werden ook contextuele factoren meegenomen zoals een recente gebeurtenis en de trend van de temperatuur.

Conclusie en aanbevelingen: Verpleegkundigen passen niet een eenduidige handelswijze toe in het geval van een geconstateerde hypo- of hyperthermie, dus verder onderzoek naar de effectiviteit van interventies is aanbevolen.

Sleutelwoorden: Preterm kind; preterme neonaat; temperatuur; hypothermie; hyperthermie

English abstract

Title: Warming up for temperature control of vulnerable preterm infants.

Introduction: Temperature regulation in preterm infants, especially below 30 weeks gestational age (GA), is a risk factor for complications, caused by temperature fluctuations. Literature about applied interventions by neonatal nurses regarding temperature regulation of preterm infants is lacking and no guideline exists at the neonatal intensive care unit (NICU) under study.

Aim: The aim of this study was to clarify the current operations at the NICU regarding temperature regulation in preterm infants below 30 weeks GA.

Research questions: - What is the incidence of hypo- and hyperthermia over a year in preterm infants below 30 weeks GA?

- Which interventions are applied by NICU nurses in case of a perceived hypo- or hyperthermia in preterm neonates below 30 weeks GA and which arguments do nurses mention to substantiate their way of handling?

Method: To answer these questions a mixed method study design was carried out at the NICU of a University Medical Centre (UMC) in The Netherlands. Quantitative data was gathered from patient files and qualitative data by semi-structured interviews. The study-population consisted of 107 preterm infants below 30 weeks GA and inborn in 2013 and five staff nurses of the NICU.

Results: A significant correlation was found between birth weight and the presence of hypothermia ($p < .05$). Nurses mentioned different applied interventions, but extra attention was paid to the smallest infants. Arguments for their way of handling were mainly based on intuition, taken into account context factors like recent happenings and the trend of the temperature.

Conclusion and recommendations: No unequivocal way of handling is carried out by nurses in case of a perceived hypo- or hyperthermia, so further research about the effectiveness of interventions regarding temperature regulation in this vulnerable population is recommended.

Keywords: Preterm infant; preterm neonate; temperature; hypothermia; hyperthermia

