Neonatal Guideline

Chapter 2: Early care of Very Premature Babies
V2014.1

Specialty: Neonatal Medicine
Revised by: Dr. Joanna Webb
Edited by: Dr. Sujoy Banerjee
Date Revised: 10th October 2014
Approved by: W&CH Clinical Governance Committee
Date Ratified: 21st January 2015
Date for Review: 31st January 2018
### Directorate of Women & Child Health

**Checklist for Clinical Guidelines being submitted for Approval by Quality & Safety Group**

<table>
<thead>
<tr>
<th>Title of Guideline:</th>
<th>Chapter 2: Early care of Very Premature Babies v2014.1</th>
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<tbody>
<tr>
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<td>Joanna Webb, Edited: Sujoy Banerjee</td>
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<td>Revision incorporating recent changes in evidence based clinical practice and long term outcome data for counselling – see page 3 <strong>Already a working document for &gt; 2 months</strong></td>
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<td>Name of Pharmacist (mandatory if drugs involved):</td>
<td>Not applicable</td>
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<td>21st January 2015</td>
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Update to Guideline - Summary of changes/additions

- Added a point to trial CPAP at delivery if baby in good condition
- Added BAPM 2008 flowchart for babies <26/40
- Thermal control - added how to override thermostat in obstetric theatre
- Use of end tidal CO2 monitoring on labour ward to check ETT position
- Importance of not removing CPAP until flow driver/Fabian ready
- Changed the CPAP starting pressure to 6-8 rather than 4-6cm H2O
- Consider trial of HFNCO2 in suitable babies.
- Cumulative latest local long term outcome and benchmarking data
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Early Perinatal Care of Preterm Babies

Perinatal management plan

Babies at the threshold of viability (22 to 25 completed weeks)

Very preterm labour occurring at these gestations is a potential perinatal emergency which requires

- Explicit pre-birth counselling of parents
- Co-ordinated involvement of skilled and experienced senior members of the Obstetric, Midwifery and Paediatric teams

At Singleton we do not offer routine resuscitation to babies less than 23 weeks gestation. If the parents wish they should have the opportunity to discuss outcomes with a second senior member of the perinatal team.

Aims before delivery

- Counsel parents to agree with them a Perinatal Management Plan
- Agree an expected Birth Plan with Obstetricians to determine the optimal place, time, and mode of delivery
- Document plans in the Obstetric notes

What information do parents need?

- Counselling, preferably from the Consultant Neonatologist who will be responsible for the management of their baby after birth. If such opportunities are not available, i.e. rapid delivery, the most senior neonatologist available should counsel the parents
- Likely survival and morbidity rates (See later)
- Warning that this prognosis will need to be revised in light of clinical assessment of baby following delivery
- An assurance of the presence of a Senior Paediatrician able to assess the baby’s condition at birth and to modify treatment accordingly
- An agreed Birth plan which will explain the likely place, time and mode of delivery of their baby
- A visit to the Neonatal Intensive Care Unit before birth if possible
What information do we need from parents?

- Gain insight into their wishes and concerns
- Assess attitudes in their family network
- Acknowledge their religious and cultural beliefs
- Confirm their understanding of and agreement with the proposed plans

When agreement cannot be reached

- Offer opportunity of second opinion
- Meanwhile continue with the treatment plan until a change in clinical status or further counselling resolves the situation
- Court action is a last resort if, despite a second opinion, agreement with the parents cannot be reached

For babies born at 26-29 weeks gestation the same principle applies except that resuscitation is the norm and prognosis is much better in terms of both survival and long term outlook

The Birth Plan

- If in labour, confirm gestational age in completed weeks based on an early dating scan if available
- Only transfer to the delivery unit (or if in a DGH to a Tertiary Centre) from 22 weeks for Obstetric care or to ensure compassionate care of the infant
- Transfer to the delivery Unit (or if in a DGH to a Tertiary Centre) from 23 weeks, for implementation of the perinatal management plan
- If gestational age uncertain, assume viability: i.e. transfer and assess at delivery
- If at risk of Group B Streptococcus infection give intrapartum antibiotics
- Attempt to administer 2 doses of 12mg Betamethasone 24 hours before delivery
- Caesarian Section is usually indicated only for maternal reasons at less than 25 completed weeks gestation.
- Intrapartum Monitoring at these gestational ages should therefore be unobtrusive and done only with the consent of the parents

Management at birth:
These babies are vulnerable, delicate and bruise easily. They are prone to hypothermia, have a very thin fragile skin and lose heat and fluid trans-epidermally very quickly. They dislike handling and may rapidly “go off” during various manoeuvres e.g. attempts to site lines. Such babies should not be unnecessarily stressed. They are at particular risk of IVH, PPHN, etc.

If you have time discuss management plan at birth and outcome of extremely premature babies with parents and give them information leaflet. Inform consultant early if possible

Principles of care in the delivery room:

- Assemble the most experienced team available.
- Prepare your resuscitaire, equipments for resuscitation and transport system early
- Meticulous attention to keeping the baby warm (see plastic bag guidelines).
- Effective resuscitation with early intubation and administration of surfactant if required (see flow chart)
- Care taken to minimise pressures and oxygen to what is necessary to achieve adequate ventilation without volutrauma.

What to do at resuscitation?

Assessment at Birth:

1. Gestation certain - 23+0 to 23+6 weeks

If gestational age is certain at 23+0 – 23+6 (i.e. at 23 weeks) and the fetal heart is heard during labour, a professional experienced in resuscitation should be available to attend the birth. In the best interests of the baby a decision not to start resuscitation is an appropriate approach particularly if the parents have expressed this wish. However, if resuscitation is started with lung inflation using a mask, the response of the heart rate will be critical in deciding whether to continue or to stop and sensitively explain to the parents the futility of further interventions.

2. 24+0 to 24+6 weeks
If gestational age is certain at 24+0 – 24+6 resuscitation should be commenced unless the parents and clinicians have considered that the baby will be born severely compromised. However the response of the heart rate to lung inflation using a mask will be critical in deciding whether to proceed to intensive care. If the baby is assessed to be more immature than expected, deciding not to start resuscitation may be considered in the best interest of the baby.

3. 25 weeks and greater
When gestational age is 25+0 weeks or more, survival is now considerably greater than in 1995. It is appropriate to resuscitate babies at this gestation and, if the response is encouraging, to start intensive care.

4. Uncertain gestation:
If gestational age is uncertain, (i.e. no dating ultrasound scan) but thought to be >23+0 weeks, an ultrasound scan by an experienced sonographer should be carried out if time permits. If the fetal heart is heard during labour, a professional experienced in resuscitation and another clinician (neonatal nurse or trainee paediatrician) should be called to attend birth. A decision should then be made, in the best interests of the baby, as to whether resuscitation should begin with mask ventilation. Once begun, the response of heart rate to lung inflation will be crucial in judging how long to continue resuscitation. If there is any uncertainty about management initiate resuscitation and guidance from more senior staff should be sought urgently.

Reference:
The Management of Babies born Extremely Preterm at less than 26 weeks gestation

A Framework for Clinical Practice at the time of Birth

Established Preterm Labour

- Discussion with parents

Accurate Gestational Age?

No but thought >23³

- Clinician experienced in assessment and resuscitation present

- Call for assistance

- Comfort Care

- Resuscitate and reassess

Yes

GESTATIONAL AGE

CAESAREAN SECTION

CARE

At < 23³ weeks gestation resuscitation would not normally be carried out

23³ - 23⁰

Maternal indications only³

24⁰ - 24³

Rarely indicated³

25⁰ - 25³

Should be considered if fetal compromise occurs

Resuscitation followed by reassessment

Assessment and care consistent with parents' wishes³

Palliative care

Resuscitation and intensive care

- BAPM Working Group 2008

* Caesarean section offers no benefit to the fetus <25 weeks’ gestation and should be performed only when indicated for the health of the mother.

** Survival and outcome for infants born at 23³ – 24³ is poor. Management of an infant born at this gestation should be consistent with parents’ wishes but decisions made before birth are influenced by the baby’s condition at birth. When parents wish resuscitation the clinician’s decision to resuscitate should depend on detailed assessment of the infant’s condition. Objective criteria include movements, lack of bradycardia, presence of spontaneous respiratory efforts and response to initial resuscitation.
**Thermal care:**

We can now raise and maintain the ambient temperature of the obstetric theatre to somewhere around 25.5°C to 26°C as per national recommendation until the baby is delivered, stabilised and moved out of theatre. The airflow from the ducts has also been diverted away from the resuscitaire.

**To achieve this please follow these instructions correctly.**

1. As soon as the decision to deliver the baby in theatre is undertaken, please start the process of overriding the temperature settings
2. **Switch on the override button** on the wall behind the anaesthetists. The yellow light should come on.
3. **Turn the knob on the silver dial to maximum (29°C). Both these steps are essential.**
4. Note the baseline temperature on the **small black thermostat** on the top of this panel. This should start showing temperature rise within a few minutes.
5. The temperature normally reaches 25.5°C within 30 minutes but this may also depend on the baseline temperature. If the temperature overshoots, you can dial down the temperature control knob.
6. Once the baby is out of theatre or in an incubator, the temperature override button should be switched off and the temperature control knob turned down to minimum to bring temperature back down to more comfortable levels.

**If the baby is <28 weeks gestation - use a plastic bag:**
- Put baby feet first into bag immediately after delivery (cord clamp should be applied first). Ensure the bag is loosely sealed around the neck
- Do not dry the body
- Put under radiant warmer.
- Dry head and apply hat. An assistant could quickly measure the head circumference at this stage if condition permits
- Continue resuscitation as usual.
• There is no need to cover chest with towels so observation and auscultation is easier.
• If access is needed cut a hole in the bag.
• Keep baby in the bag until core temperature is 36.5°C and he is in a humidified incubator.
• Bags are kept with transport incubator in CDS.
Resuscitation and early care of preterm infants <28+0 weeks gestation  
(Adapted from All Wales Network Guideline) 
Prime Time

Sick or premature newborn infants do not tolerate hypothermia or handling well. The mnemonic PRIME TIME was devised by Sr Niki Harris at Royal Gwent Hospital and is a guide to the preparation for delivery and subsequent stabilisation of vulnerable infants, as soon as possible after birth, so the babe can then be left undisturbed. Prime Time allows the admission procedure to be consistent. Medical and nursing staff should work together to ensure that interventions are carried out efficiently, but without the pressure of necessarily completing it all in just one hour, if circumstances do not allow.

**Preparation** prior to delivery  
**Resuscitation** 0 to 10mins  
**Intubation** (only in selected cases)  
**Move to NICU** 10 to 15 min  
**Evaluate** 15-45 min  
**Temperature (etc.)**  
**Intravascular access**  
**Make comfortable** 45 to 60 min  
**Exit**

**Nursing Preparation Prior to Delivery** (all infants <28+0/40)  
- Liaise with colleagues and define roles  
- Check NICU admission space, including ventilator  
- Set incubator humidity to 90 %  
- Prepare to run through fluids aseptically  
- Take surfactant out of fridge. Do not draw up in babies > 26 weeks gestation  
- Check monitors with appropriate attachments  
- Check transport incubator
Medical Preparation Prior to Delivery (all infants <28°0 weeks)

- Notify consultant
- Medical staff identified and prepared to go to delivery
- Consider thermal control and need to override thermostat if in theatre
- Ventilator set up at required settings – SIMV 20/4, Ti 0.3 sec, rate 60/min
- Suction and catheters present and working
- Transport incubator checked and taken to delivery unit
- Check resuscitaire
  Plugged in and working
  Pressures 20/4, T-piece circuit with PEEP, in air
  Plastic bag
  Heat maximum
  Gas cylinders full
  Suction working with catheter attached
- Stethoscope to hand
- 2 working laryngoscopes of appropriate size
- ETT available with fixation devices
- Kit for surfactant administration available
- Hat for baby
- Review mother’s notes/ history
- Discussion of management plan with parents beforehand (with written outcome information)

When the baby is born – nursing tasks (0-10mins) (<28°0 weeks)

- Start clock
- Note time
- Place infant in plastic bag
- Assist with resuscitation as required, including CPAP / ETT fixation as applicable
- Hat
- Assist with surfactant administration if intubated
- Commence pulse oximetry
• Check Vit K consent and administer
• If resuscitation is prolonged - nurse on a transwarmer and transfer to transport incubator on this
• Ensure name tags are available and labelled correctly and applied to infant
• Move to transport incubator when ready

When the baby is born – medical tasks (0-10mins) (<28*0 weeks)
• Assess A,B,C
• If baby is vigorous and in very good condition, breathing regularly and pink apply PEEP 6-8 cms water (via face mask or CPAP prongs) as soon as possible. This will reduce subsequent ventilation by ~50%. However, in the presence of multiple risk factors predicting a greater severity of RDS such as infection, no / inadequate antenatal steroids or oligohydramnios, it may be advantageous to electively ventilate and administer prophylactic surfactant.
• If an experienced neonatologist is present and baby does not have sufficient respiratory effort - intubate immediately with largest size ETT possible (size 3.0 mm and only 2.5mm for very small infants).
• Check tube position by auscultation in both axillae and ensure equal air entry. If not possible to intubate commence inflation breaths / ventilation breaths with face mask and neopuff and retry when baby is pink with a good heart rate
• Consider use of end tidal CO2 monitoring – this will help to confirm correct placement of ET Tube and is available to use on labour ward.
• Warm surfactant (Curosurf 200mg/kg) and administer as soon as possible once ETT correctly positioned and secured.
• Gentle ventilation at 20/4. Monitor effect by heart rate
• Use air / 30% oxygen for lung inflation, increasing to higher oxygen if persistent bradycardia or cyanosis
• Monitor heart rate and saturation levels
• If lack of response consider reintubation
• Move to transport incubator when stable
• Check baby ventilating satisfactorily at desired settings in transport incubator prior to leaving MDU
Transfer to NNU (10-15mins)
- Use dedicated transport system
- Monitor babies during transfer to labour ward
- For babies on CPAP - apply binasal prong CPAP with BabyPac on the transport incubator and transfer to NICU promptly.

Admission to NNU – nursing tasks (15-60 min) (<28*0 weeks)
- Nurse remains with baby for entire Prime Time
- Weigh baby in plastic bag
- Transfer to incubator still in bag
- Attach to ventilator / CPAP machine and ensure humidifier is working. Ensure that baby is ventilating well
- Attach ECG leads
- Ensure that baby is nursed in incubator humidity 90%
- Take temperature and cuff blood pressure
- If baby is cold place on transwarmer
- Commence monitoring (skin temp, saturation, ECG)
- Record baseline observations
- Insert NGT/OGT
- Give Vit K (if not already given) and antibiotics
- Run through aseptic fluids and attach to lines once inserted
- Prepare morphine and any other infusions required
- Photograph for parents
- Register baby, admit to ward, print stickers (delegate if possible)
- Speak to parents, obtain telephone numbers etc.
- Leave baby to rest

Do not remove from bag until all procedures complete and incubator temperature and humidity optimised
Admission to NICU – medical tasks (15-60 min) (<28⁰ weeks)

- Reassess ABC and examine infant generally
- Do baseline capillary blood gas and blood glucose
- If on nCPAP – do not remove prongs until the Fabian/infant flow driver CPAP is ready to use to avoid atelectasis.
- Adjust ventilator settings. Anticipate changes in resistance and compliance post surfactant and reduce pressures as necessary. Target oxygen saturations should be 91-94% with a pCO2 to keep pH>7.25
- Note baseline observation and blood pressure. Target mean blood pressure > gestation.
- Calculate doses to complete drug and fluid prescription charts - first line antibiotics usually benzylpenicillin and gentamicin to be given once the blood culture has been obtained. Start 10% dextrose only if central line is intended or otherwise start on peripheral TPN at 90ml/kg/day. Morphine infusion usually commences at 5 to 10micrograms/kg/hour
- Consider need for Umbilical access / percutaneous long line.
  Using a very strict aseptic technique, (sterile gown, cap, mask, gloves) Prepare to insert UAC followed by UVC. A formula for UAC length in cm is twice weight, plus 9, plus length of cord stump. For UVC measure, in cm from umbilicus to Xiphisternum plus length of cord stump and insert by this length. (see clinical procedures guideline)
- Take blood for gas, culture (0.5 to 1ml of blood if possible), CRP, glucose, FBC, blood group, plus others as per local guideline e.g. lactate, clotting, LFT
- Check ETT position and line positions on X ray. UAC should be in a high position (as local guideline, but usually between T6 and T9/10). If too low it can be withdrawn to a low position between L3 and L4. A UVC should be in the IVC below the diaphragm. Repeat X ray if lines adjusted
- Complete paperwork
- Speak with parents
- Leave baby to rest with minimal handling.

This is a guideline only, and clinical circumstances may dictate different management. This will be decided individually by the attending teams.
References
1. Primetime Audit, NICU, Royal Gwent Hospital, Sr Niki Harris 2009

Further management of ventilated babies: (See flow chart)

Most babies who have received antenatal steroids and surfactant require minimal ventilation and FiO2 in the first few hours. Consider Volume guarantee ventilation. If your PIP is greater than 18 cm and FiO2 >0.4, consider complications such as pneumothorax, congenital pneumonia, ET tube in the right main bronchus, surfactant administration in one lung etc. Request an early chest X-ray in this situation and if there is still evidence of surfactant deficient lung disease repeat surfactant dose. You do not need to wait for 12 hours to repeat surfactant dose.

Wean ventilation as tolerated using the principle of permissive hypercapnia (Ph >7.25, pCO2 <8kpa).

Do not start morphine routinely. If heading for extubation load with caffeine.
**Flowchart showing management plan on NICU for ventilated babies**

**Ventilated babies less than 28\(^{\circ}\) gestation**
- Plastic bag
- Early high dose surfactant
- Low pressure ventilation with PEEP of 5 cm
- Minimise FiO2

**Admit to NICU (Prime time)**
- Conventional ventilation (Short I\(_T\), Ideally VG with TV 4-6 mls/Kg
- Blood gas
- BP monitoring
- Delay opiates
- Load with caffeine
- Consider Central Lines

**< 30 O\(_2\)**
- 23-25 weeks
  - No opiates
  - Continue gentle ventilation until ready for extubation
- 26-27 weeks
  - No opiates
  - Elective extubation to CPAP/Adv. CPAP
  - Do not extubate if for transfer out

**30 -50\% O\(_2\)**
- Continue CV + VG
- Monitor TV
- Consider Opiates
- Ensure optimal pressures

**> 50\% O\(_2\)**
- Consider cause:
  - ETT position
  - Severe RDS
  - Pneumothorax
  - Pneumonia
  - Pulmonary hypoplasia
  - PPHN

- Consider early 2\(^{\text{nd}}\) dose surfactant if FiO2 >0.4 and or MAP >8cm

Neonatal Guidelines v 2014 1
Chapter 2: Early care of Very Premature Babies

Valid until 31\(^{\text{st}}\) January 2018
**Management of babies on nasal CPAP:**

**On arrival:**
Apply infant flow nasal CPAP 6-8cmH₂O immediately. Try not to take the baby off the Neopac CPAP until the infant flow driver is set up, then transfer directly.
Allow permissive hypercapnia PaCO₂ up to 7-8.5 kPa (50-64mmHg)
Allow FiO₂ to go up to 0.4

**But only after you have checked:**
- The prongs are in the nose
- They are the right size
- The neck is slightly extended
- The nose has been cleared (suctioned)
- Baby is nursed prone/ or side to side
- You have tried higher pressures 8-9 cm H₂O or more.

Consider trial of High Flow Nasal Cannula Oxygen therapy prior to intubation if baby has adequate respiratory effort.

**Criteria for reventilating babies on nasal CPAP:**

**Intubate and ventilate if there is any of the following:**
- FiO₂ > 0.4 to maintain sats > 91% (after initial stabilisation).
- PaCO₂ > 8kPa (60 mmHg) (capillary gases can be used)
- Apnoea unresponsive to stimulation or frequent: > 6 in 6 hrs needing stimulation or severe: more than 1 episode of neopuffing
- Acidosis (after initial stabilisation)
  Arterial pH <7.25 and PaCO₂ > 8 kPa (60 mmHg)

Consider other causes for respiratory deterioration apart from prematurity (e.g. pneumothorax, diaphragmatic hernia, pulmonary hypoplasia, pneumonia, congenital lung anomaly, neuromuscular problem)
Short and long term outcome for premature babies – Local and National data

Table1: Survival to Discharge -All Infants Admitted to Singleton Hospital Neonatal Intensive Care Unit - 2006-2011 (Inclusive)

<table>
<thead>
<tr>
<th>Gestation at birth (weeks)</th>
<th>Survival at discharge</th>
<th>Absolute Numbers</th>
<th>%</th>
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<tr>
<td>23</td>
<td></td>
<td>9/18</td>
<td>50</td>
</tr>
<tr>
<td>24</td>
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<td>17/34</td>
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Table 2: TRENT Survival data: survival to discharge of European infants known to be alive at the onset of labour

<table>
<thead>
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<th>Birth weight (g)</th>
<th>0th centile</th>
<th>10th centile</th>
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<tr>
<td>3000</td>
<td>98</td>
<td>95</td>
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<td>250</td>
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**Fig 1** Median (95% confidence interval) predicted percentage survival for European infants known to be alive at onset of labour. Values above 90th centile represent infants large for gestational age, values below 10th centile represent infants small for gestational age.

*BMJ* 1999; 319; 1093-1097

Graph 1: EPICURE Studies: Survival to discharge of babies 22-25 weeks gestation admitted to NICU in 1995 and 2006

Babies admitted for Intensive Care in ENGLAND in 1995 and in 2006

- **EPICure 1 (1995)**
- **EPICure 2 (2006)**

*not a statistically significant rise*
Long Term Outcomes:

We have now 4 year cumulative outcome for majority of moderately premature (less than 32 weeks gestation at birth OR less than 1500 grams at birth) infants cared for in our Health Board at the age of 2 years (corrected for prematurity). This includes information on 400 babies during this period.

The data from the early years is mostly from babies born or cared for in Singleton Hospital but from 2009 onwards includes all eligible infants within the Health Board.

This is summarised in the table below. More detailed breakdown of this data is available on our audit and annual report pages under the clinical governance tab.

Table 3: Summarised outcome of babies born between 2006-2011 and admitted to Singleton NICU

<table>
<thead>
<tr>
<th>2 years corrected age</th>
<th>Survival (% of NICU admissions)</th>
<th>Death or disability (% of NICU admissions)</th>
<th>Survival free of disability (% of survivors assessed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 32 weeks AND / OR &lt;1500gms</td>
<td>89%</td>
<td>24%</td>
<td>81%</td>
</tr>
<tr>
<td>Extreme prematurity &lt;26 weeks</td>
<td>60%</td>
<td>56%</td>
<td>68%</td>
</tr>
</tbody>
</table>
Graph 2 – Long term outcome data of 22-25 weeks gestation babies in the UK – Epicure 1 cohort - 1995

- 24% severe disability
- 49% no disability
- 2% died
- 24% disability not severe
- 1% no data

Graph 3: Epicure 2 – Long term outcome data of 22-26 weeks gestation babies in England at 3 years of age – Epicure 2 cohort

- No impairment
- Mild impairment
- Moderate impairment
- Severe impairment

Proportion (\%)

<table>
<thead>
<tr>
<th>Gestation (completed weeks)</th>
<th>22-23</th>
<th>24</th>
<th>25</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=38</td>
<td>26%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=98</td>
<td>15%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=189</td>
<td>14%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=251</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>