Regionalisation of perinatal care in Portugal
Why and how was it accomplished

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Summary

• The Portuguese National Health Care System
• The Reform and organization of perinatal care – Why and How
• The Portuguese Neonatal Transport System
• Results
• 10 000 000 inhabitants
• 100 000 live births/year
Health Care System

• National Health Service, from 1979 – provided by the State.
• Subsystems – offered by some companies (including State)
• Private insurances – a growing field with multiple policies and levels
National Health Service

• Universal – everyone have access to health care even illegal immigrants, unemployed, etc.

• “Gratis” – Not paid when services are used. However a small amount is paid at that time to discourage abusive use. Costs are supported by the State; the money is got from taxes.

• One given person may have access to health care through public service always and, simultaneously, to private care through sub systems or private insurance.
Perinatal care in Portugal
1980s – Organization at a glance

1980 – The first NICUs, first “true” ventilators

1985 – Neonatal Branch of the Portuguese Society of Paediatrics, nowadays the Portuguese Neonatal Society

1987 – National neonatal transport system


1989 – National Committee for Women and Child Health

1989 - Perinatal Health Care Reform
WHY

Until the seventies of twentieth century and even during eighties despite some NICUs, there were:

- More than 200 hospitals with deliveries
- A great part without obstetrician or paediatrician
- A great percentage of pregnancies without prenatal care
- Few neonatal intensive care units
- Perinatal mortality rate was one of the highest in the European countries
WHY

• In 1987 an Experts Committee was nominated by the Health Ministry aiming to collect and analyse data on perinatal care all over the country and to suggest improvements to change the picture.
• The Report resulting from this work is the main document on which is based the reform.
• As a result the Health Ministry nominated these Experts Committee as the Mother and Child Health Committee and give them power to start the reform of perinatal care.
Hospitals with deliveries were visited, all over the country, during months and months: three neonatologists, three obstetricians, one paediatrician, one member of the Health Ministry…
The Report - The 1989 reform

A 9 years programme in 3 years stages

• Closure of hospitals with less than 1500 deliveries/year

• Reclassification of hospitals: I, II and III level.

• Coordinating Units between health centres and hospitals

• Equipping neonatal intensive and intermediate care units

• Definition of needs of obstetricians, paediatricians and nurses

• Specialised training in neonatology
HOW

• Defining levels of perinatal care

• Defining localization of each level of hospital according to:
  - The number of deliveries in one geographic area
  - Geographic difficulties and existing routes and connections - high ways, mountains, time spent to achieve the hospital, etc

• Defining steps for opening and closure of different levels of hospitals
HOW

• Defining how many obstetricians, paediatricians and nurses and which training they should have according to the level of care.

• Defining the equipment required for health centres, delivery rooms, neonatal units according to the level of care and predefining the type of equipment

• Buying the equipment directly through a “grant” of Health Ministry to equip hospitals – foetal monitors, incubators, ventilators, monitors, infusion pumps, etc
HOW

• Taking profit of those NICUs already equipped to improve their performance giving new equipment

• Creating a specific training in neonatology – a 6 months training after the title of paediatrician to be obtained in a level III NICU with those former neonatologists trained in other countries – starting in 1990

• Creating the National Neonatal Transport System
Public Perinatal Network  
Levels of perinatal care

Health Centres – No deliveries. Follow-up of normal pregnancies. Family doctors

Level I Hospitals – No deliveries. No outpatient clinic for pregnant women

Level II Hospitals (named Perinatal Care Hospitals) – Normal and low risk deliveries; at least 1500/year; obstetricians; intermediate care unit; paediatricians with competence in neonatology; short course ventilation.

Level III Hospitals (named Differentiated Perinatal Care Hospitals). More than 3000 deliveries/year; normal, low and high-risk deliveries; obstetricians and neonatologists; NICU; referral centres; teaching on obstetrics and neonatology. Scientific research.
Perinatal care levels

Deliveries

Level III Hospital

Deliveries

Level II Hospital | Level II Hospital

Coordinating Units | Coordinating Units

Health Centres | Health Centres
Organization
Number of obstetrical beds

• Delivery room – 3 to 4 beds per 1000 deliveries year if rooms are for labour and delivery; 2 to 3 beds if there is a room for labour and another one for delivery

• Obstetrical nursery – 20 beds /1000 deliveries year. Four of these beds were for pregnant women
## Number of obstetricians and Pediatricians

<table>
<thead>
<tr>
<th>Number of deliveries</th>
<th>Number of Obstetricians</th>
<th>Number of Pediatricians</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2500</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>&lt; 2500</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>&gt;3000</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>2000 to 3000</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>&lt; 2000</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Equipment and staff for intermediate care units

• 5 beds, including 2 incubators/1000 LB
• 1 ventilator for short course ventilation
• CR and apneia monitors
• FiO2 measurement
• Phototherapy
• Infusion pomps
• Resuscitation equipment
• Pediatrician expert in neonatology for 24h
• Nurses with experience in neonatology – 1 for 3 to 4 newbors (1,2 to 1,5 nurses/bed)
Intensive care units

• Long term ventilation
• Parenteral nutrition
• Care for VLBW neonates
• Surgical conditions
• Training and research centres
Intensive care units

• Neonatologists and paediatricians with competence in neonatology 24h a day

• 1.5 beds/1000 deliveries

• 1 nurse for 2 intensive care beds – 2,5 nurses/intensive bed

• Seated at maternities with >3000 deliveries

• A level III hospital receive normal pregnancies of their geographic area
Prenatal referral to a level III hospital

- Prenatal diagnosis of congenital anomalies
- GA < 32 weeks
- Multiple delivery < 34 weeks GA
- Severe blood group immunization
- Fetal hydropsis
- Fetal metabolic disorders
- Pre-eclampsia, HELLP, severe maternal disease
Postnatal referral to a level III Hospital

• Birth weight <1500g
• Respiratory distress needing long term mechanical ventilation or FiO2>40%
• Conditions needing surgical intervention
• Diseases needing extended studies for definitive diagnosis
Perinatal and neonatal transport
Perinatal transport

For pregnant women

- Medical Emergency National Institute (INEM) or
- Local hospital ambulance or
- Fireman ambulance

For foetus/newborn

- “In uterus” transport is highly recommended.
- Neonatal transport – National Institute for Medical Emergency (INEM).
Neonatal transport
Neonatal INEM
(National Institute for Medical Emergency)

• National organization from 1987
• Centralized in a III level centre
• North, Centre, South
• The ambulance is a NICU
• Newborn cared for by a neonatologist and an neonatal nurse recruited amongst NICUs staff as an extra
• For long distances – air transport
National Neonatal Transport System

North

Centre

South

Azores

Madeira
Coordination between level II and level III hospitals are up to Neonatal Transport System

Back transport of patients to level II hospital when intensive care is not needed is up to Level III hospital
The impact of regionalization on outcomes
# Imediate Results

<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ner Hospitals</td>
<td>493</td>
<td>202</td>
</tr>
<tr>
<td>Hospitals with deliveries</td>
<td>&gt; 200</td>
<td>50</td>
</tr>
<tr>
<td>In hospital delivery rates</td>
<td>73,8%</td>
<td>98,8%</td>
</tr>
</tbody>
</table>
Public hospitals with perinatal care

Level II - 27; Level III – 21 (including islands)

<table>
<thead>
<tr>
<th>Intensive care beds by centre</th>
<th>5 to 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50 VLBW infants</td>
<td>10/21 NICU</td>
</tr>
<tr>
<td>&gt; 35 VLBW infants</td>
<td>14/21 NICU</td>
</tr>
<tr>
<td>Surgical centres (2)</td>
<td>Surgeries/year: 2&gt;70; 1&gt;40</td>
</tr>
<tr>
<td>Cardiac centres (5)</td>
<td>3 South; 1 Centre; 1 North</td>
</tr>
</tbody>
</table>
Level III hospitals

- Azores: 2900LB
- Madeira: 2700LB

Total deliveries:
- 4900 deliveries
- 6200 deliveries
- 20000 LB
- 32000LB
- 34100 LB
- 2900LB
- 2700LB
### Perinatal data – 2009

**Livebirths – 99 576**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prematurity</td>
<td>8.8%</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>8.2%</td>
</tr>
<tr>
<td>Very low birth weight</td>
<td>0.9%</td>
</tr>
<tr>
<td>Prenatal care (VLBW)</td>
<td>94.7%</td>
</tr>
<tr>
<td>Prenatal steroids &lt; 34 weeks</td>
<td>87%</td>
</tr>
<tr>
<td>VLBW survival</td>
<td>88%</td>
</tr>
<tr>
<td>Mother age &gt; 35</td>
<td>19.2%</td>
</tr>
<tr>
<td>Mother age &lt; 20</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

*According to INE and VLBW National Network*
Foetal and late foetal mortality rates

/1000LB+SB

Foetal (>22w)  Late Foetal (>28w)
Late foetal mortality rate in EU (2005)

/1000 live births plus still born =>28weeks GA

Source: Eurostat 2008
Perinatal mortality rates in Portugal

Perinatal >28 weeks
Perinatal >22 weeks
Perinatal mortality rate in EU (2005-2007)

Per thousand live births

WHO/Europe 2008
Neonatal mortality rate in Portugal (/1000LB)


15.7 8.1 3.6 2.7 2.1 2.1 2.1 2.4

Source: INE
Neonatal mortality rate in EU (2005-2007)

Per thousand live births

WHO/Europe 2008
VLBW mortality rates

/1000 live births + stillborn > 500gr; /1000 alive births >500gr

Source: DGS/INE
Infant mortality rate (/1000LB)

Source: INE

Source: Eurostat 2008
VLBW neonatal mortality rates according to gestational age groups

According to INE
Survival of VLBW by birth weight
n=3561
2005-2008

VLBW National Network – Portuguese Neonatal Society
In uterus transfer of VLBW infants (%)
According to VLBW National Network, 2010
### VLBW mortality rate
#### Level of birth and care

<table>
<thead>
<tr>
<th>1996-2000</th>
<th>Level II</th>
<th>Level III</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality / Place of care</td>
<td>39%</td>
<td>26%</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

According to VLBW National Network 2010
### VLBW mortality rate

**In uterus vs postnatal transport**

<table>
<thead>
<tr>
<th>Mortality</th>
<th>inborn</th>
<th>outborn</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-2003</td>
<td>21%</td>
<td>46%</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>2005-2009</td>
<td>12%</td>
<td>26%</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*According to VLBW National Network 2010*
Access to risk appropriate perinatal care influence mortality outcomes
CP rates/1000 live births in 10 European countries, births cohorts 1990-1998
SCPE Collaborative network
Cerebral palsy at 5 years in Portugal (2001 - 110 156 LB)  
Virella D. et al, 2010

<table>
<thead>
<tr>
<th>TORCH infection</th>
<th>(11/206 - 5.3%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxoplasmosis</td>
<td>1</td>
</tr>
<tr>
<td>CMV</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes associated to great immaturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>47/206 (22.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Postneonatal infection</th>
<th>(13/206 - 6.3%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herpetic Encephalitis</td>
<td>4</td>
</tr>
<tr>
<td>Viral encephalitis</td>
<td>3</td>
</tr>
<tr>
<td>Meningitis</td>
<td>3</td>
</tr>
<tr>
<td>Encefalomielitis</td>
<td>1</td>
</tr>
<tr>
<td>Post malaria encephalitis</td>
<td>1</td>
</tr>
<tr>
<td>Sepsis</td>
<td>1</td>
</tr>
</tbody>
</table>
Maternal mortality rates
European countries, USA, Canada and Portugal
2001-2005 (/100 000 live births)

According to WHO
Direct and indirect contributors

- Increasing socioeconomic conditions, higher educational level. Democratic revolution - 1974
- Neonatal Society – 1987
- National neonatal transport system - 1987
- Perinatal health care reform – 1989
- Post graduation in Neonatology - 1990
- National VLBW network - 1996
Conclusions

- Socioeconomic and cultural conditions of a population are very important factors for a high pattern of health care. This influence was also very important for National data improvement
- However, the organizational issue is one of the most important factors that influence data and regionalization proved to be a very cost-effective way to improve perinatal health care
Source of data

• National Committee for Maternal and Infant Health Report 1989
• Directorate-General of Health (DGS) - Mother and Child Hospital Referral Network, 2000
• National Institute for Statistics (INE) - Demographic Statistics
• Portuguese VLBW Network – Portuguese Neonatal Society
• World Health Organization
• Eurostat
## Causes of death 2009

<table>
<thead>
<tr>
<th></th>
<th>Neonatal deaths</th>
<th>Infant deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Congenital anomalies</strong></td>
<td>12.2%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Gestation and foetal growth problems</td>
<td>10.6%</td>
<td></td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>69%</td>
<td></td>
</tr>
</tbody>
</table>

Source: INE 2010
## Causes of foetal death 2005

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before onset of labor (54.8%)</td>
<td></td>
</tr>
<tr>
<td>Maternal hypertension, infection, others mother related (not placenta related)</td>
<td>20.5%</td>
</tr>
<tr>
<td>Cord anomalies (8.7% from total)</td>
<td>15.8%</td>
</tr>
<tr>
<td>Congenital anomalies</td>
<td>9.2%</td>
</tr>
<tr>
<td>Immaturity related causes</td>
<td>18.2%</td>
</tr>
<tr>
<td>Perinatal asphyxia</td>
<td>11.4%</td>
</tr>
</tbody>
</table>

Source: INE 2010
How does prenatal transport work?
The best practice

• A 28 weeks pregnant woman is at home. She lives >80km far from a level III hospital. Rupture of membranes occur spontaneously.
• She goes to her level II hospital to be observed.
• The obstetrician says she have to go to a level III hospital; prescribes betametasone, contacts Neonatal Transport System (INEM) who centralises information, and ask for a bed in a level III hospital.
How does prenatal transport work?
The best practice

• INEM contacts the maternity they know to have place for the newborn.
• If NICU accept the newborn infant obstetricians from the original hospital contacts the obstetrician of the level III hospital
• The woman in transferred. Her transport in an ambulance is up to the level II hospital
How does postnatal transport work? 
The best practice

• A 28 weeks pregnant woman is at home. She lives >80km far from a level III hospital. Rupture of membranes occurs spontaneously and she starts in labour.
• She goes to her level II hospital to be observed
• The obstetrician says she has full dilation and the baby is about to born. There is no time to transfer the woman to a level III hospital.
• He calls Neonatal Transport System (INEM) telling the situation.
How does postnatal transport work?
The best practice

- INEM calls the maternity they know to have place for the neonate and ask for his/her admission.
- Delivery occurs in the level II hospital and the newborn is transferred to the level III Unit transported by INEM
The Portuguese VLBW Network 1996 - 2004

Destination on discharge

34 % transferred back to level II hospitals
VLBW follow-up 1994 survivors
Follow-up at 3-6 years
n=263

8/13 NICU

Lost for follow-up - 36%

263

238

159

Evaluated - 169

Dead  Without follow-up  Missing  Evaluated

205/100
VLBW follow-up 1994 survivors
Follow-up at 3-6 years
Evaluated 169/263

- Normal 66%
- Problems 29%
- Death 5%
- Minor
  - MAJOR 7.6%
  - Minor
## Maternal death

### Table

<table>
<thead>
<tr>
<th>ANOS</th>
<th>MORTES</th>
<th>TAXA /100000 NV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>127</td>
<td>73,5</td>
</tr>
<tr>
<td>1975</td>
<td>77</td>
<td>42,9</td>
</tr>
<tr>
<td>1980</td>
<td>31</td>
<td>19,6</td>
</tr>
<tr>
<td>1981</td>
<td>29</td>
<td>19,1</td>
</tr>
<tr>
<td>1982</td>
<td>34</td>
<td>22,5</td>
</tr>
<tr>
<td>1983</td>
<td>23</td>
<td>15,9</td>
</tr>
<tr>
<td>1984</td>
<td>22</td>
<td>15,4</td>
</tr>
<tr>
<td>1985</td>
<td>14</td>
<td>10,7</td>
</tr>
<tr>
<td>1986</td>
<td>12</td>
<td>9,5</td>
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<td>1987</td>
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<td>12,2</td>
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<td>1988</td>
<td>8</td>
<td>6,6</td>
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<td>1989</td>
<td>12</td>
<td>10,1</td>
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<td>1990</td>
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<td>1991</td>
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<td>12,0</td>
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<td>1992</td>
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<td>9,6</td>
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<td>1993</td>
<td>7</td>
<td>6,1</td>
</tr>
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<td>1994</td>
<td>10</td>
<td>9,2</td>
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<td>5,3</td>
</tr>
<tr>
<td>1998</td>
<td>9</td>
<td>7,9</td>
</tr>
<tr>
<td>1999</td>
<td>6</td>
<td>5,2</td>
</tr>
</tbody>
</table>

### Graph

(Diagram showing the trend of maternal death rates from 1970 to 1999, with a significant decrease over time.)

**Direcção-Geral da Saúde**

Directorate General of Health – Epidemiological Division
Maternal mortality rate
(/100 000 live births)

Ventura T. According to DGS/INE