Thoughts on Prematurity and Low Birth Weight In Colorado

James S Barry, MD
-Medical Director University of Colorado Hospital Neonatal Intensive Care Unit
-Associate Professor, University of Colorado School of Medicine,
-Contact info: james.barry@ucdenver.edu
May 4, 2016
I HAVE NO $ DISCLOSURES, DESPITE...
TRYING. I HAVE WORKED WITH MOD AND CDPHE.
Objectives

• Define current state of low birth weight and premature deliveries in the US and Colorado and how it impacts outcomes
• Describe outcomes related to prematurity over the past two decades
• Identify practical steps to decrease preterm and low birth weight delivery rates in Colorado
Colorado Annual Birth Number = 65,000

Table 10. Births, by race of mother: United States, each state and territory, 2014

[By place of residence]

<table>
<thead>
<tr>
<th>Area</th>
<th>All races</th>
<th>White</th>
<th>Black</th>
<th>American Indian or Alaska Native</th>
<th>Asian or Pacific Islander</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States1</td>
<td>3,988,076</td>
<td>3,019,863</td>
<td>640,562</td>
<td>44,928</td>
<td>282,723</td>
</tr>
<tr>
<td>Alabama</td>
<td>59,422</td>
<td>39,578</td>
<td>18,417</td>
<td>200</td>
<td>1,227</td>
</tr>
<tr>
<td>Alaska</td>
<td>11,392</td>
<td>7,288</td>
<td>548</td>
<td>2,450</td>
<td>1,106</td>
</tr>
<tr>
<td>Arizona</td>
<td>86,887</td>
<td>72,687</td>
<td>5,208</td>
<td>5,473</td>
<td>3,519</td>
</tr>
<tr>
<td>Arkansas</td>
<td>38,511</td>
<td>29,632</td>
<td>7,376</td>
<td>301</td>
<td>1,202</td>
</tr>
<tr>
<td>California</td>
<td>502,879</td>
<td>383,492</td>
<td>31,654</td>
<td>3,509</td>
<td>84,224</td>
</tr>
<tr>
<td>Colorado</td>
<td>65,830</td>
<td>58,117</td>
<td>3,926</td>
<td>777</td>
<td>3,010</td>
</tr>
<tr>
<td>Connecticut</td>
<td>36,285</td>
<td>28,543</td>
<td>5,154</td>
<td>308</td>
<td>2,280</td>
</tr>
<tr>
<td>Delaware</td>
<td>10,972</td>
<td>7,314</td>
<td>2,988</td>
<td>26</td>
<td>644</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>9,509</td>
<td>3,985</td>
<td>5,026</td>
<td>16</td>
<td>482</td>
</tr>
<tr>
<td>Florida</td>
<td>219,991</td>
<td>159,035</td>
<td>53,148</td>
<td>406</td>
<td>7,402</td>
</tr>
</tbody>
</table>
There is a Problem

• Too many of these births are:
  – Premature (born before 37 weeks)
  – Of low birth weight (<2500g)
  – Born Late preterm (34-37 weeks).

= >5000

MANY HAVE SIGNIFICANT ISSUES, EARLY AND LATE.
National Premature Delivery Rates
<table>
<thead>
<tr>
<th>Grade</th>
<th>Preterm birth rate range</th>
<th>Scoring criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Preterm birth rate less than or equal to 8.1%</td>
<td>Score less than or equal to 0.0</td>
</tr>
<tr>
<td>B</td>
<td>Preterm birth rate of 8.2% to 9.2%</td>
<td>Score greater than 0.0, but less than or equal to 1.0</td>
</tr>
<tr>
<td>C</td>
<td>Preterm birth rate of 9.3% to 10.3%</td>
<td>Score greater than 1.0, but less than or equal to 2.0</td>
</tr>
<tr>
<td>D</td>
<td>Preterm birth rate of 10.4% to 11.4%</td>
<td>Score greater than 2.0, but less than or equal to 3.0</td>
</tr>
<tr>
<td>F</td>
<td>Preterm birth rate greater than or equal to 11.5%</td>
<td>Score greater than 3.0</td>
</tr>
</tbody>
</table>
Colorado Annual Premature Delivery Rates

Preterm is less than 37 completed weeks gestation.

1200 less premature deliveries in Co 2013 compared to 2003

Goal 2020
March of Dimes Goal, 8.1% by 2020

2015 PREMATURE BIRTH REPORT CARD

<table>
<thead>
<tr>
<th>Colorado</th>
<th>Preterm Birth Rate</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.4%</td>
<td>B</td>
</tr>
</tbody>
</table>

Getting Closer, over 2500 less premature births annually compared to 2003, but not quite

The enemy of better is good.
Disparity index- preterm live birth for an ethnic group with the lowest rate in a region
Preterm Birth Rate, MOD Goal is 8.1% by 2020

CITIES

Cities with the greatest number of births are graded based on their 2013 preterm birth rates. The status indicator shows whether the 2013 city rate is higher (●), lower (●), or the same (●) as the 2013 state rate (8.6%).

<table>
<thead>
<tr>
<th>City</th>
<th>Preterm birth rate</th>
<th>Grade</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>8.4%</td>
<td>B</td>
<td>●</td>
</tr>
<tr>
<td><strong>Colorado Springs</strong></td>
<td>10.0%</td>
<td>C</td>
<td>●</td>
</tr>
<tr>
<td>Aurora</td>
<td>9.1%</td>
<td>B</td>
<td>●</td>
</tr>
<tr>
<td>Fort Collins</td>
<td>6.8%</td>
<td>A</td>
<td>●</td>
</tr>
<tr>
<td>Lakewood</td>
<td>8.2%</td>
<td>B</td>
<td>●</td>
</tr>
<tr>
<td><strong>Pueblo</strong></td>
<td>10.3%</td>
<td>C</td>
<td>●</td>
</tr>
</tbody>
</table>
Preterm Birth Rates

• There are regions and ethnic groups identified in which we could and should focused on to decrease preterm delivery rates.
Low Birth Weight

- <2500g at birth
Colorado has one of the highest low birth weight rates in the nation.

- In 2012, 8.8 percent of Colorado babies were born at a low birth weight.
- The Healthy People 2020 goal for the nation is 7.8 percent.
National Low Birth Weight Delivery Rates (<2.5kg)

From the CDC website, www.cdc.gov. Data for 2014

- Number of babies born low birthweight (less than 2500 grams): 318,847
- Percent born low birthweight: 8.00%
- Percent born very low birthweight: 1.40% <1500 g
- Number of preterm births: 381,321
- Percent born preterm: 9.57%
Colorado Annual Low Birth Weight Delivery Rates

Low birthweight is less than 2500 grams (5 1/2 pounds).

Low Birth Weight

• Associated factors:
  – Pregnancy Factors:
    • Low and advanced maternal age
    • Multiples in gestation- Co, 2400
    • Prenatal care (PRAMS data show 20% get late PNC in Co)
  – Social Determinants:
    • Nutrition
    • Stress
    • Racial-Ethnic Disparities
    • Socioeconomic
  – Maternal Factors:
    • Smoking- Over Co, 1000 women smoking while pregnant
    • Diabetes/Hypertension-Co, 500+
    • ETOH- ? (PRAMS data, only 70% of clinicians spoke with a pregnant mother about the evils of ETOH during pregnancy)
Low Birth Weight

- Associated factors:
  - Altitude: May be one of the most important factors. Birth weight $\downarrow$ 150g for every 3280 ft $\uparrow$

Waldhoer J Perintaoology 2015
Low Birth Weight, Altitude, Gestational Age

Biggest altitude weight difference is with lower gestational ages

Waldhoer J Perinatology 2015
Low Birth Weight Birth Rates

- Desire a 1% reduction in Low Birth Weight annual delivery rates - Goal of Healthy People 2020.

X 650
National Data, Extreme Prematurity
# Survival at Limits of Viability

## Trends in Care Practices, Morbidity, and Mortality of Extremely Preterm Neonates, 1993-2012

Barbara J. Stoll, MD; Nellie I. Hansen, MPH; Edward F. Bell, MD; Michele C. Walsh, MD, MS; Waldemar A. Carlo, MD; Seetha Shankaran, MD; Abbot R. Laptok, MD; Pablo J. Sánchez, MD; Krisa P. Van Meurs, MD; Myra Wyckoff, MD; Abhik Das, PhD; Ellen C. Hale, RN, BS, CCRC; M. Bethany Ball, BS, CCRC; Nancy S. Newman, BA, RN; Kurt Schibler, MD; Brenda B. Poindexter, MD, MS; Kathleen A. Kennedy, MD, MPH; C. Michael Cotten, MD, MHS; Kristi L. Watterberg, MD; Carl T. D’Angio, MD; Sara B. DeMauro, MD, MSCE; William E. Truog, MD; Uday Devaskar, MD; Rosemary D. Higgins, MD; for the Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network

Prospective registry of 34 636 infants, 22 to 28 weeks’ gestation born at 26 network centers between 1993 and 2012.

<table>
<thead>
<tr>
<th></th>
<th>1993 (n = 1433)</th>
<th>2012 (n = 1922)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1 Prenatal visit</td>
<td>1233 (87)</td>
<td>1835 (97)</td>
</tr>
<tr>
<td>Multiple birth</td>
<td>265 (18)</td>
<td>521 (27)</td>
</tr>
<tr>
<td>diabetes</td>
<td>28 (2)</td>
<td>96 (5)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>172 (12)</td>
<td>508 (27)</td>
</tr>
</tbody>
</table>

### Survived to Discharge Among All Infants

By gestational age, wk

<table>
<thead>
<tr>
<th></th>
<th>1993 (n = 1433)</th>
<th>2012 (n = 1922)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>5/79 (6)</td>
<td>7/75 (9)</td>
</tr>
<tr>
<td>23</td>
<td>34/122 (28)</td>
<td>50/150 (33)</td>
</tr>
<tr>
<td>24</td>
<td>85/163 (52)</td>
<td>174/269 (65)</td>
</tr>
<tr>
<td>25</td>
<td>153/225 (68)</td>
<td>249/308 (81)</td>
</tr>
<tr>
<td>26</td>
<td>208/250 (83)</td>
<td>291/333 (87)</td>
</tr>
<tr>
<td>27</td>
<td>238/283 (84)</td>
<td>337/357 (94)</td>
</tr>
<tr>
<td>28</td>
<td>284/311 (91)</td>
<td>405/430 (94)</td>
</tr>
</tbody>
</table>

JAMA Sept 8, 2015
National Prematurity Data

Specific Neonatal Morbidity Over Time

- Necrotizing enterocolitis
  - Adjusted RR (95% CI), change per year
  - 1993-2008: 1.02 (1.01-1.03)
  - 2009-2012: 0.94 (0.91-0.98)

- Late-onset sepsis

- Severe intracranial hemorrhage

- Periventricular leukomalacia
  - Adjusted RR (95% CI), change per year
  - 1993-2003: 1.02 (1.01-1.03)
  - 2004-2012: 0.94 (0.93-0.95)

- Retinopathy of prematurity ≥ stage 3

- Bronchopulmonary dysplasia
National Prematurity Data

BPD By Gestational 1993 - 2012
Colorado Data (Some), Extreme Prematurity
Vermont Oxford Network (VLBW International Database)

Colorado Collaborative, 10 NICUs in Colorado

<table>
<thead>
<tr>
<th>Center</th>
<th>City</th>
<th>State</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children's Hospital, The</td>
<td>Aurora</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Saint Joseph Hospital</td>
<td>Denver</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Rocky Mountain Hospital for Children at P/SL</td>
<td>Denver</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Rose Medical Center</td>
<td>Denver</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>UCHSC</td>
<td>Aurora</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>St. Mary's Hospital and Medical Center</td>
<td>Grand Junction</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Swedish Medical Center</td>
<td>Englewood</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Poudre Valley Health System</td>
<td>Fort Collins</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Good Samaritan Medical Center</td>
<td>Lafayette</td>
<td>Colorado</td>
<td>United States</td>
</tr>
<tr>
<td>Denver Health Medical Center</td>
<td>Denver</td>
<td>Colorado</td>
<td>United States</td>
</tr>
</tbody>
</table>
Prematurity Data

Survival to DC By Gestational Age Over Time

Stoll B, JAMA 2015
Colorado VLBW VON Data 2015, 5 year averages

• Mortality:
  – VON= 10% - Co= 7.6%

• Severe retinopathy of prematurity:
  – VON=4.9% - Co=3.7%

• Severe Intraventricular Hemorrhage:
  – VON=5% - Co=4.9%

In general, survival rates and morbidity rates are similar or better than VON averages.
Late Preterm Birth

When is safe...safe?
Not Always Considered a Problem

• Late Preterm Birth (34-37 weeks gestation at birth).
  – Just a smaller version of a term infant
  – The largest portion of pre term deliveries are those in the late preterm category.

• But…..
  – 7X higher risk or neonatal morbidities than FT (respiratory issues, hyperbilirubinemia, hypoglycemia, hypothermia, feeding difficulties).
  – 18% higher rate of behavioral problems at preschool age compared with >37 week controls. Potijk BMJ, 2012
Late Preterm Births Are Substantial

<table>
<thead>
<tr>
<th>Year</th>
<th>Births</th>
<th>Preterm</th>
<th>Early term</th>
<th>Full term</th>
<th>Late term</th>
<th>Postterm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total under 37 weeks</td>
<td>27 weeks and under</td>
<td>28–31 weeks</td>
<td>32–33 weeks</td>
<td>34–36 weeks</td>
</tr>
<tr>
<td>2014</td>
<td>3,988,076</td>
<td>9.57</td>
<td>0.69</td>
<td>0.91</td>
<td>1.15</td>
<td>6.82</td>
</tr>
<tr>
<td>2013</td>
<td>3,932,181</td>
<td>9.62</td>
<td>0.70</td>
<td>0.92</td>
<td>1.17</td>
<td>6.83</td>
</tr>
<tr>
<td>2012</td>
<td>3,952,841</td>
<td>9.76</td>
<td>0.71</td>
<td>0.92</td>
<td>1.17</td>
<td>6.96</td>
</tr>
<tr>
<td>2011</td>
<td>3,953,590</td>
<td>9.81</td>
<td>0.70</td>
<td>0.93</td>
<td>1.18</td>
<td>6.99</td>
</tr>
<tr>
<td>2010</td>
<td>3,999,386</td>
<td>9.98</td>
<td>0.71</td>
<td>0.94</td>
<td>1.18</td>
<td>7.15</td>
</tr>
<tr>
<td>2009</td>
<td>4,130,665</td>
<td>10.07</td>
<td>0.71</td>
<td>0.94</td>
<td>1.18</td>
<td>7.24</td>
</tr>
<tr>
<td>2008</td>
<td>4,247,694</td>
<td>10.36</td>
<td>0.71</td>
<td>0.95</td>
<td>1.22</td>
<td>7.47</td>
</tr>
<tr>
<td>2007</td>
<td>4,316,233</td>
<td>10.44</td>
<td>0.74</td>
<td>0.97</td>
<td>1.22</td>
<td>7.51</td>
</tr>
</tbody>
</table>
Late Preterm Birth #’s in US Are Substantial

- 7% = 279,000 neonates annually
- 6% with Resp Morbidity = 16,740 newborns (1/3\textsuperscript{rd} require intubation) Mcintire D. Ob and Gynecol, 2008
Late Preterm Morbidities

- 22% = US, 61,380 newborns annually with significant morbidities.
- Colorado = roughly 1200 newborns annually.

Colin A, Pediatrics 2010
Cost of Late Preterm Births

- $5.45 Billion to age 18
- $5.55 Billion to age 18
- $10.56 Billion to age 18

Colorado Late Preterm Delivery Rates

This has gone down because of collaborative efforts in Co.

Late preterm is between 34 and 36 weeks gestation.

Data from Co Infant Mortality Dashboard

### PT-ETB3: Early Non-medically Indicated Elective Delivery (%)

<table>
<thead>
<tr>
<th></th>
<th>Quarters 1-3 2015</th>
<th>Target</th>
<th>Performance</th>
<th>2014 Final</th>
<th>Change Since 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Races</td>
<td>26.3%</td>
<td>23.0%</td>
<td></td>
<td>24.9%</td>
<td>↑</td>
</tr>
</tbody>
</table>

### PT-ETB2: Early Term Birth (%)

<table>
<thead>
<tr>
<th></th>
<th>Quarters 1-3 2015</th>
<th>Target</th>
<th>Performance</th>
<th>2014 Final</th>
<th>Change Since 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Races</td>
<td>24.1%</td>
<td>21.4%</td>
<td></td>
<td>23.8%</td>
<td>↑</td>
</tr>
</tbody>
</table>

*Singleton live births delivered between 37 and 38 weeks.*

### Quarters 1-3 2015 Provisional Data: 4,375 total preterm births. 2014 Final Data: 5,514 total preterm births.

### CW6: Preterm Birth Rate (%)

<table>
<thead>
<tr>
<th></th>
<th>Quarters 1-3 2015</th>
<th>Target</th>
<th>Performance</th>
<th>2014 Final</th>
<th>Change Since 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Races</td>
<td>8.7%</td>
<td>8.2%</td>
<td></td>
<td>8.4%</td>
<td>↑</td>
</tr>
<tr>
<td>NH White</td>
<td>8.2%</td>
<td>8.2%</td>
<td></td>
<td>7.9%</td>
<td>↑</td>
</tr>
<tr>
<td>NH Black</td>
<td>11.7%</td>
<td>8.2%</td>
<td></td>
<td>10.7%</td>
<td>↑</td>
</tr>
<tr>
<td>Hispanic</td>
<td>9.2%</td>
<td>8.2%</td>
<td></td>
<td>8.7%</td>
<td>↑</td>
</tr>
<tr>
<td>NH American Indian/Alaska Native</td>
<td>9.7%</td>
<td>8.2%</td>
<td></td>
<td>9.4%</td>
<td>↑</td>
</tr>
<tr>
<td>NH Asian/Pacific Islander</td>
<td>9.5%</td>
<td>8.2%</td>
<td></td>
<td>9.5%</td>
<td>↔</td>
</tr>
</tbody>
</table>

*Infants born prior to 37 weeks gestational age. NH: non-Hispanic.*

*Colorado's Infant Mortality Collaborative Improvement and Innovation Network (CoIIN)*
Summary

• Rates of preterm deliveries, low birth weight deliveries, and late preterm deliveries are higher than we would like it to be nationally and in Colorado.

• They come with significant health and financial implications.
We Know.... Can We Do Better?

Do the best you can until you know better.
Then when you know better, do better.

- Maya Angelou
The Solutions are Simple
Doing Them Is Complex
We Underestimate the Complexity of Our Care and Care Systems
US Healthcare System Is Fractured
We Are The Center, Not Patients
No New Interventions Are Needed
We Need to Better Utilize What We Already Have
We Need to Get It To Patients in a Timely and Effective Manner
Improving NICU Care

• There have been significant advances in neonatal care over the past several decades
  – Oxygen/Surfactant/iNO
  – TPN/nutrition
  – Neonatal ventilators/isolettes/CPAP

But these tools/interventions need to be applied/used correctly, on the right patients, at the right time, by the right people.
Healthcare Struggles With The Later

In many respects, the U.S. health care system is breathtakingly innovative. It produces new technology, medical procedures, and scientific knowledge at a dazzling speed, enabling patients to recover from diseases and injuries once thought incurable or untreatable. As a consequence, the U.S. has one of the highest survival rates for cancers, excels at acute and trauma care, and has produced half of the world’s Nobel laureates.\textsuperscript{1,2}

• Delivery of such breathtaking care lags way behind;
  – 55% of adults get recommended care
  – <50% of children get EBM care in outpt setting

Mangione-smith, \textit{NEJM} 2007
McGlynn, \textit{NEJM} 2003
Aspen Institute, 2014, reinventing healthcare
Got a pill for that?
A Simple blood cell transfusion for a patient – 31 STEPS

Is a transfusion needed?

Essentials of decision on transfusion
- Assess clinical condition
- Use clinical guidelines
- Inform patient and obtain consent
- Record the decision and rationale

Essentials of ordering blood component
- Identify the patient correctly
- Take blood sample and correctly label the tube
- Complete the request/electronic order form correctly
- Take note of special transfusion requirements
- Send the sample and request form to the Blood Bank
- Communicate with Blood Bank if blood is required urgently

Essentials of monitoring transfused patient
- Monitor patient’s vital signs regularly
- Recognise, diagnose respond to adverse event
- Record outcome of transfusion
- Assess need for further transfusion

Essentials of pretransfusion testing
- Determine patient’s ABO and RhD type
- Detect clinically significant red cell antibodies
- Select and crossmatch red cell units
- Apply compatibility label

Essentials of administering blood components
- Identify the patient correctly
- Ensure there is a written instruction to transfuse
- Record pretransfusion vital signs
- Check (control) patients blood group if this normal procedure
- Repeat check of patient identification against component label/documentation
- Inspect component unit/check expiry date
- Set rate of transfusion according to instructions
- Complete all documentation

Essentials of delivery to clinical area
- Component labelling must match patient identifiers
- Record removal of unit from storage location
- Deliver to appropriate person in clinical area
- Maintain correct storage conditions until transfusion

Assess the patient and decide whether to transfuse

Order the blood component

Monitor the patient

Pre-transfusion testing

Administer the blood component

Deliver the blood component
Safer Deliveries Colorado


• Trying to do just that-
  – Have invited all 51 hospitals in Colorado that perform deliveries
  – Right care, To the Right People, At the Right Time
  – Overall Goals:

  • Reduce low-birthweight deliveries to no more than 7.8 percent of live births
  • Reduce preterm births to no more than 9.6 percent of live births
Goals

- Low birthweight deliveries at 8% or less
- Preterm births at or below 9.6

Principal Initial Interventions

- Administration of progesterone to prevent repeat early deliveries
- Use of premature labor assessment toolkit
Progesterone for Women with Previous Preterm Births

Access to progesterone

- Medicaid will cover administration of Makena without prior authorization.
- Makena is now available through a Denver pharmacy and shipped to any location.

Progesterone information sheet

- Available from MOD toolkit
- In English and Spanish
- Considering how to distribute it more widely
Progesterone Works to Decrease Preterm Deliveries in Some

• Is it being used as it should be?
  – Not very frequently
    • 7% in La, of 3000 eligible only 400 received it.

Orsulak, Clin Ther 2015.
Preterm Labor Assessment Toolkit

Resources from toolkit:

- Preterm labor assessment pre-implementation survey
  - Has self-assessment questions for hospitals
  - Will send survey to participating hospitals
  - Will use this for discussion during site visits

- Algorithm for preterm labor triage assessment
- Preterm labor assessment chart audit tool
Safer Deliveries Colorado

• Who should we contact for questions?
• Please contact Nancy Griffith at Colorado Hospital Association at 720.330.6067 or nancy.griffith@cha.com.
If you do not change direction, you may end up where you are heading.

Lao Tzu