

## *Sunday, April 10 Presentations*



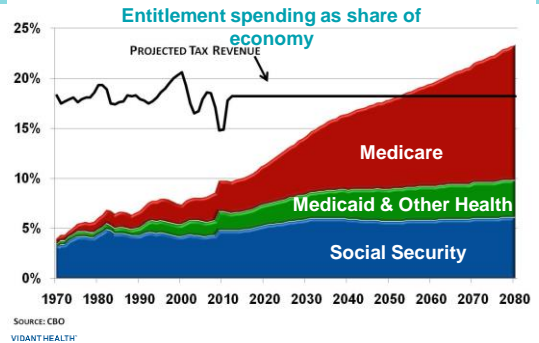
## Population Health, ACO's, and How Vidant Health Is Preparing for the Next Phase of Healthcare Delivery

### North Carolina Obstetrical and Gynecological Society April 10, 2016

D. Paul Shackelford, MD FACOG  
Sr Vice President, Medical Affairs  
Vidant Medical Center  
Clinical Associate Professor  
East Carolina University  
Greenville NC



## Burning platform for change



## HHS's Ambitious Goals:

### Moving to alternative payment models:

- **By end of 2016:** tie 30 % of fee-for-service, Medicare payments to quality or value through alternative payment models, such as Accountable Care Organizations (ACOs) or bundled payment arrangements
- **By end of 2018:** 50 % percent of payments to these models

### Moving traditional fee for service payment too:

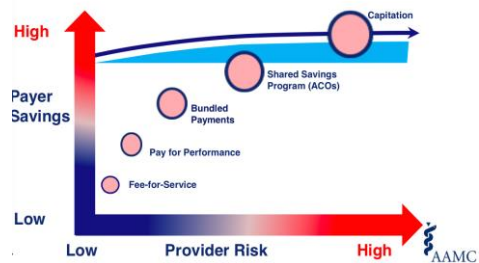
- **2016:** tie 85% of payment to quality or value (HVBP, HRRP, e.g.)
- **2018:** move to 90%



Sylvia M. Burwell  
N Engl J Med 2015; 372:897-899 March 5, 2015 DOI:  
10.1056/NEJMp1500445

2

## Continuum of Risk-Based Payment Models



3

The Current System: Volume Based	The Future State: Value Based
Provide a service, get paid.	Provide a service and your payment will vary depending on such factors as: <ul style="list-style-type: none"> <li>• Meeting quality measures</li> <li>• Participating in alternative payment models</li> <li>• Being in a primary care medical home that meets the standards set out by the Center for Medicare and Medicaid Innovation (CMMI)</li> </ul>
The more services you provide, the more revenue you get	Starting in 2019 (based on performance in 2017) payments will be linked to quality and value under a Merit-based Incentive Payment System



4



5

- Hospital based-
- Commercial and Federal ranking-Transparency
  - Competitive statistics
- Narrow initiatives- CJR
- Population health
- Physicians

## Hospital based

Track	2016	2018
<b>TRACK 1</b> Value Based Purchasing, Readmission reduction program, Hospital acquired conditions, physician value based modifier	85%	90%
<b>TRACK 2</b> ACO/Medical Homes, Bundled Payment	30%	50%

For the first time, the US Department of Health and Human Services (HHS) sets clear goals and timeline for shifting Medicare reimbursement from volume to value



6

## FY 2016 Hospital Acquired Conditions

**25%**  
Agency for  
Healthcare  
Research & Quality  
Measures

- Patient Safety Indicator 90 (PSI 90)

**75%**  
Centers for Disease  
Control &  
Prevention National  
Healthcare Safety  
Network

- CLABSI
- CAUTI
- Surgical site infection following Colon Surgery or Abdominal Hysterectomy



7

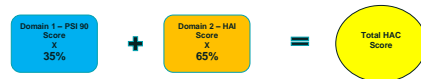
## Patient Safety Indicator Composite (PSI-90)

Patient Safety Indicator Measure	Measure Weight in PSI-90 Composite
PSI-15 Accidental Puncture or Laceration	42.89%
PSI-12 Postop PE or DVT	22.09%
PSI-3 Decubitus Ulcer	13.57%
PSI-7 Selected Infection due to medical care	8.31%
PSI-6 Iatrogenic Pneumothorax	6.14%
PSI 13- Postop Sepsis	5.36%
PSI 14- Postop Wound Dehiscence	1.59%
PSI 8- Postop Hip Fracture	0.05%

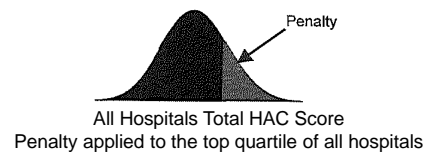


8

## HAC: How are Hospitals Evaluated?



### Penalty Allocated



9

## RRP: FY 2015 (Jul 2010 – Jun 2013)

### FY 2015 Readmission Reduction Program Indicators

1. Heart Attack
2. Heart Failure
3. Pneumonia
4. Chronic Obstructive Pulmonary Disease
5. Total Hip/Total Knee Replacement



10

## RRP: How are Hospitals Evaluated?

- Only acute care hospitals, critical access hospitals excluded
- Excess readmission ratio calculated based on readmission performance compared to the national average
- Base DRG payment "penalized" the readmission adjustment ratio (no more than 3% total penalty)



11

## VBP: FY 2015 (Oct 2011 – Jun 2013)

2015 Indicators  
Domain Percentage  
(34 indicators)



■ Clinical Process  
■ Patient Experience  
■ Outcomes  
■ Efficiency

Measure	Domain
2 - Heart Attack core measures	Clinical Process
Heart Failure core measure	Clinical Process
2- Pneumonia core measures	Clinical Process
5 - Surgery Core measures	Clinical Process
Cardiac Core measure	Clinical Process
Surgery Blood clot measure	Clinical Process
9 - Inpatient experience	Patient Experience
Heart attack mortality	Outcomes
Heart failure mortality	Outcomes
Pneumonia mortality	Outcomes
Central Line blood stream infection	Outcomes - NEW
8 - Patient Safety Indicator 90	Outcomes - NEW
Medicare Spending Per Beneficiary	Efficiency *NEW*

## Vidant Health Hospital based Risk

Medicare Payment Reform Program	Maximum Revenue Impact to Vidant Health (millions)		
	2015	2016	2017
Value Based Purchasing (VBP)	3.0	3.5	4.1
Readmission Reduction Program (RRP)	4.8	5.6	5.6
Hospital Acquired Condition (HAC)	3.1	3.2	3.3
<b>TOTAL</b>	<b>10.9</b>	<b>12.3</b>	<b>13</b>



13

## Many ratings with conflicting messages



healthgrades

ConsumerReports



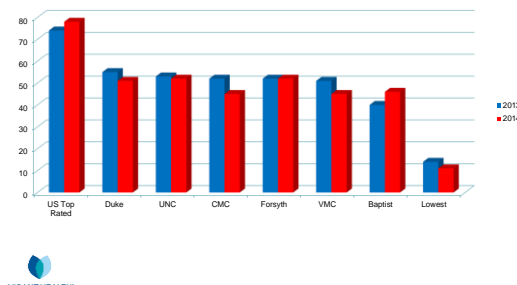
TRUVEN  
HEALTH ANALYTICS

More Than Data.  
Answers.

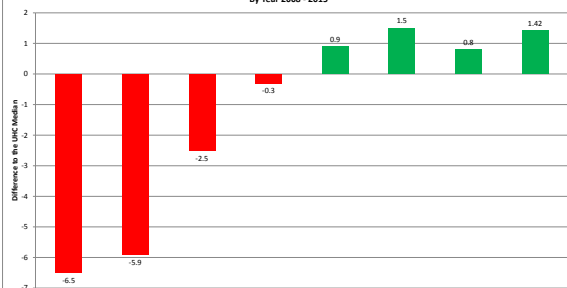


## Consumer Reports Hospital Safety Score Ratings

Hospital Safety Score Rating Comparisons  
NC Academic Hospitals



VMC Quality and Accountability Score Compared to Median UHC Hospital Score  
By Year 2008 - 2015



## The One that matters



17

## Part of overall CMS quality reporting approach

- Nursing Home Star Rating
- Dialysis Facility Star Rating
- Home Health Star Rating
- Hospital Patient Experience Rating ( OBH 5 Star all other VH hospitals 4 Star for patient experience)

...and now Overall Hospital Quality Star Rating



18

## Methodology

- Same data as in the CMS payment reform programs
  - Value based purchasing (VBP)
  - Hospital acquired conditions (HAC)
  - Readmission reduction program (RRP)
- Same issues with lag time in data used – some measures based on data as much as 4 years old



19

## National Performance

Rating	Number of Hospitals
1 Star	142
2 Star	716
3 Star	1881
4 Star	821
5 Star	87



20

## Episode based Bundles

- CJR –Comprehensive Joint Replacement. Mandatory for 800 hospitals
- BCPI- Bundle Care Payment initiative. Voluntary alternate payment model

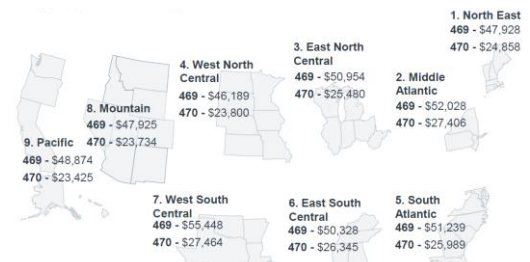


21

- Base Numbers-Total cost for 90 days Starting day of admission
- CMS sets your new target at 3% less- “House always wins...”
- IF Quality is acceptable AND you meet or come in under the target, You have opportunity to recover a portion of the savings.



22



23

## CJR Estimates 90 days



24

## Quality

- Composite quality score totaling 20 points based on 3 measures
- Hospital-Level, Risk-Standardized Complication Rate following Elective Primary Total Hip Arthroplasty and/or Total Knee Arthroplasty NQF 1550- (10 points)
- Hospital-Level, HCAHPS (8 points)
- Voluntary submission of PRO data (2 points)



25

## Risk-standardized complication rate, NQF 1550

- acute myocardial infarction;
- pneumonia, or sepsis/septicemia within 7 days of admission;
- surgical site bleeding, pulmonary embolism or death within 30 days of admission; or
- mechanical complications, periprosthetic joint infection, or wound infection within 90 days of admission.



26

## Hospital-Specific Performance Relative to Blended Target Price and Quality Performance Proxy Performance Year

- AHA analysis

CMS Certification Number (CCN)	Hospital Name	Region	Episode Spending for DRGs 469/470		Quality Performance				
			Number of Episodes	Weighted Average of Actual Episode Spending in Proxy Performance Year	Weighted Average of Blended Target Price	Estimated Composite Quality Score	Quality Category	Eligible for Reconciliation Payment	Effective Discount Percentage for Reconciliation Payment
340040	VMC	South Atlantic	450	\$25,167	\$24,020	6.80	Good	Yes	2.0%



27

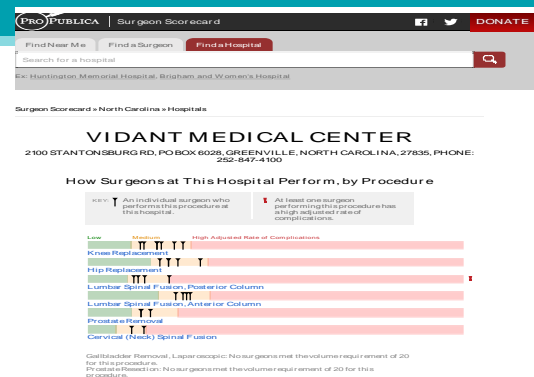
## Physicians

- What's at Stake for Physician
- Professional fees moving to outcomes based adjustments
- Merit-Based Incentive Payment System [MIPS]
- Physician Compare
- Third party ranking Facebook, "Angie's List", ProPublica



28

## Physician performance





## Timeline: How Much Payment Is At Risk?

Potential Reductions	2015	2016	2017	2018	2019	2020	2021	2022
Medicare EHR Incentive	-1.5% or -2.0% <sup>1</sup>	-2.0%	-3.0%	Up to -4.0% <sup>1</sup>	--	--	--	--
PQRS	-1.5%	-2.0%	-2.9%	-2.0%	--	--	--	--
Value-modifier (Max reduction) <sup>2</sup>	-1.0%	-2.0%	-4.0%	-4.0%	--	--	--	--
MIPS	--	--	--	--	-4.0%	-5.0%	-7.0%	-9.0%
Total Possible Reduction	-4.5%	-6%	-9%	-10%	-4%	-5%	-7%	-9%

Based on the MIPS composite performance score, providers receive positive, negative, or neutral payment adjustments

- 2019: +/- 4%
- 2020: +/- 5%
- 2021: +/- 7%
- 2022 and beyond: +/- 9%

## MIPS Public Reporting

- Information about the performance of MIPS EPs must be made available on Physician Compare:
  - Composite score for each EP and performance in each category
  - Names of EPs in APMs
  - May include performance regarding each measure or activity in resource use

RFI: October 1, 2015  
Comments due 11/17/15

Proposed Rule: Spring 2016

Final Rule: November 2016

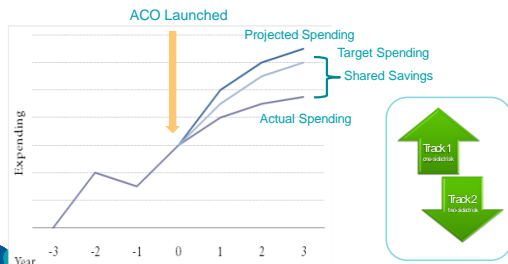
APM/MIPS Implementation: January 2019 (based on performance in 2017)

- Accountable care organizations [ACO]
- Medicare Shared Savings Program [MSSP]
- Shared savings???



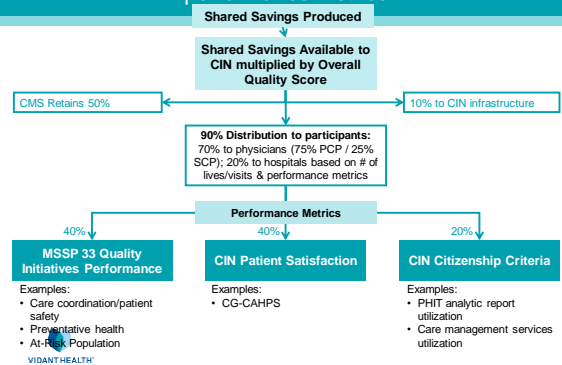
## The shared savings model and

Accountable Care Organizations (ACOs) connect groups of providers who are willing and able to take responsibility for improving the health status, efficiency and experience of care for a defined population



Scrimgeour, John "What Could be Next for Health Reform? The Debate in Washington" Presentation/The Dartmouth Institute for Health Policy & Clinical Practice 2009-07-02

## Shared Savings distribution depends on achieving performance metrics



Ahhhhhhh.....!!!!!!



38

## What are "Value-Based" Models?

### FFS with bonuses/ penalties

- Hospital VBP penalties

### Episode-Based Payment

- BPCI voluntary program
- CJR mandatory program

### Population-Based Payment

- Accountable care organizations
- Prospective capitation

VIDANT HEALTH

39



40

Population Health, ACO's, and How Vidant Health Is Preparing for the Next Phase of Healthcare Delivery

North Carolina Obstetrical and Gynecological Society  
April 10, 2016

D. Paul Shackelford, MD FACOG  
Sr Vice President, Medical Affairs  
Vidant Medical Center  
Clinical Associate Professor  
East Carolina University  
Greenville NC



VIDANT HEALTH



## The Perinatal Quality Collaborative of NC (PQCNC) and The NC Partnership for Maternal Safety

Arthur Ollendorff, MD

NC OB/GYN Society Annual Meeting  
April 10, 2016

Perinatal Quality Collaborative of North Carolina



Arthur Ollendorff, MD

Director of Maternal Projects  
Perinatal Quality Collaborative of NC

MAHEC OB/GYN Specialists  
Asheville, North Carolina

Arthur.Ollendorff@mahec.net

Perinatal Quality Collaborative of North Carolina



## Conflict of Interest Statement

- I have no conflicts of interest, real or otherwise, related to this presentation

Perinatal Quality Collaborative of North Carolina



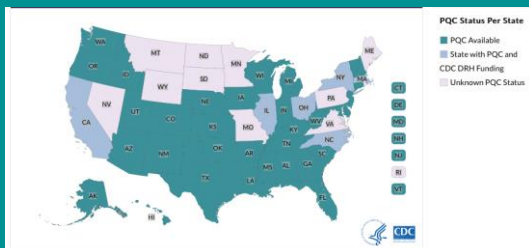
## Objectives

- Update on activities of the Perinatal Quality Collaborative of North Carolina
- Introduce the North Carolina Partnership for Maternal Safety
- Learn about the NC Fetal Alcohol Prevention Program

Perinatal Quality Collaborative of North Carolina



## State Perinatal Quality Collaboratives



Perinatal Quality Collaborative of North Carolina



Making North Carolina the best place to give birth and be born!

Perinatal Quality Collaborative of North Carolina



## Accomplishing the Mission

- Create value through time limited statewide perinatal QI projects
  - Best evidence, reduce variation
  - Partnership with patients and families
  - Resource optimization
- Projects developed and led by expert teams with members from multiple hospitals
- Work conducted by local Perinatal Quality Improvement Teams facilitated/supported by PQCNC core team

Perinatal Quality Collaborative of North Carolina



## PQCNC Initiatives

- Central-Line Associated Blood Stream Infections (CABSI)
- 39 weeks
- Study of Intended Vaginal Birth (SIVB)
- Patient-Family Engagement (PFE)
- Exclusive Breastmilk
- Conservative Management of Preeclampsia (CMOP)\*
- Neonatal Abstinence Syndrome (NAS)\*
- Screening for Critical Congenital Heart Disease (CCHD)\*

\* Current projects

Perinatal Quality Collaborative of North Carolina



## Conservative Management of Preeclampsia (CMOP)

- Aims to create and strengthen a multidisciplinary hospital-based community focused on providing a standardized approach to the diagnosis and management of patients with hypertension in pregnancy in North Carolina
- This will be achieved with a focus on
  - Patient and family engagement
  - Proper diagnosis of hypertension in pregnancy
  - Proper management of preeclampsia and gestational hypertension
  - Proper post-partum education and follow-up

Perinatal Quality Collaborative of North Carolina



## CMOP: Pilot Phase and Phase 1

### Pilot Phase

- Feb 1 – Dec 31, 2014
- 21 participating sites
- 45% of NC deliveries
- Did not include chronic HTN diagnosis
- Focused on proper diagnosis and timing of delivery

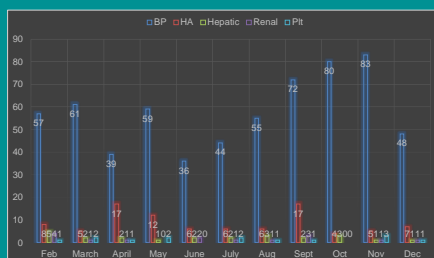
### Phase 1

- March 1 – Dec 31, 2015
- 23 participating sites
- 47% of NC deliveries
- Includes chronic HTN diagnoses
- Focusing on timing of delivery and time to treatment of severe range BP

Perinatal Quality Collaborative of North Carolina



## CMOP Pilot Phase: Criteria for Severe Disease



Perinatal Quality Collaborative of North Carolina



## CMOP Phase 1 Interim Data (Unvalidated)

(3/1/15-12/31/15)

- 45,406 total deliveries at 21 actively participating sites
- 6280 with any HTN diagnosis (13.8% HTN rate)
  - 2442 Cesarean deliveries (39% Cesarean Rate)
  - 1603 delivered < 37 weeks (26% PTD rate)
  - 108 potentially unindicated preterm deliveries
    - 52 delivered for gestational hypertension
    - 56 delivered for preeclampsia without severe features

Perinatal Quality Collaborative of North Carolina



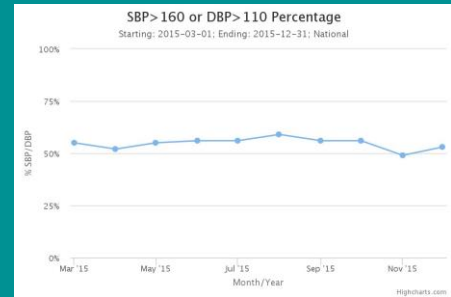
## CMOP Phase 1 Interim Data (3/1/15-12/31/15)

Diagnosis	> 37 weeks	< 37 weeks	Total
Gestational HTN	2214	201	2415
PreEclampsia without SF	544	136	780
PreEclampsia with SF	650	747	1397
Chronic HTN	965	231	1196
Superimposed PreE without SF	127	245	372
Superimposed PreE with SF	77	43	120

Perinatal Quality Collaborative of North Carolina



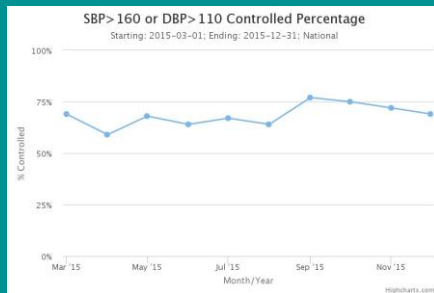
## CMOP Phase 1 Interim Data



Perinatal Quality Collaborative of North Carolina



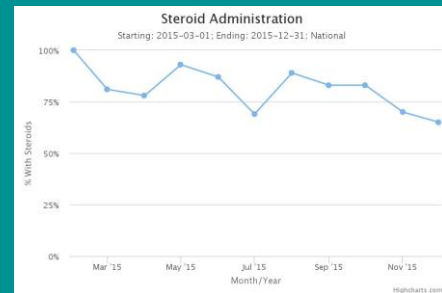
## CMOP Phase 1 Interim Data



Perinatal Quality Collaborative of North Carolina



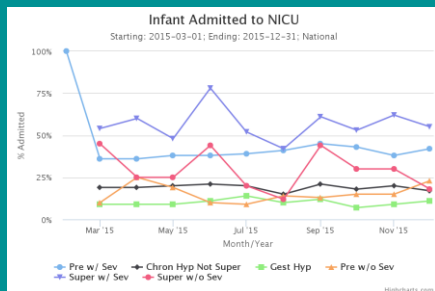
## CMOP Phase 1 Interim Data



Perinatal Quality Collaborative of North Carolina



## CMOP Phase 1 Interim Data



Perinatal Quality Collaborative of North Carolina



## CMOP Phase 2

- Kicked-off on February 10, 2016
- Action plan broken down into 4-5 months long focus areas
  - February-May: Beside Engagement
  - May-September: Antenatal Steroids/Magnesium
  - September-January: Discharge Education
- Data collection decreased
  - “Full” data on preterm deliveries
  - Limited data set on term deliveries with severe range BP

Perinatal Quality Collaborative of North Carolina



## CMOP Phase 2

- Hospital Co-Leads
  - Help develop improvement plans
  - Identify information of interest and resources to share with teams
  - Assist in facilitating learning sessions and webinars
- Hospital Teams
  - Learning Sessions: Each hospital must have at least 2 team members attend all learning sessions
  - Webinars: Each hospital must have at least 1 team member attend all webinars
  - Data: Data is due by the 15<sup>th</sup> of each month

Perinatal Quality Collaborative of North Carolina



## C-MOP Phase 2 Participating Sites



Perinatal Quality Collaborative of North Carolina



## CMOP: ABOG Approved QI Project

- Approval from January 1, 2015 through December 31, 2017
- "The ABOG MOC standards now allows participation in ABOG-approved Quality Improvement Projects to meet the annual improvement in Medical Practice (Part IV) MOC requirement. This QI project has been approved to meet ABOG improvement in Medical Practice requirements for 2015."
- Four physicians received MOC Part IV credit for their participation in CMOP in 2015

Perinatal Quality Collaborative of North Carolina



## NC Partnership Mission Statement

The North Carolina Partnership for Maternal Safety is an extension of the National Partnership for Maternal Safety and is working to implement the three Maternal Safety Bundles within all 80 NC maternity hospitals. The Partnership is a growing multi-stakeholder effort comprised of leaders from organizations across the spectrum of women's health care including hospitals and health systems, physician and nurse professional associations, payers, and state agencies that are focused on strategies to improve maternal health and safety in North Carolina

Perinatal Quality Collaborative of North Carolina



## NC Partnership for Maternal Safety

- A multi-stakeholder effort to implement the three Maternal Safety Bundles in all 80 NC maternity hospitals
  - NC Quality Center
  - NC Medical Society (including NC OB/GYN Society)
  - NC Section ACOG
  - PQCNC
  - CCNC Pregnancy Medical Home
  - NC Medicaid
  - Blue Cross/Blue Shield
  - AWHONN
  - American College of Nurse Midwives, NC branch
  - DPH, Women's Health Branch
  - NC Perinatal Association
  - NC Academy of Family Physicians
- [www.ncsafemoms.org](http://www.ncsafemoms.org) and @ncsafemoms

Perinatal Quality Collaborative of North Carolina



## NC Partnership for Maternal Safety

- First meeting was July 10, 2015
  - Inventory of OB QI projects in state
  - Developed a strategy to identify and engage clinical and administrative OB lead in each maternity hospital
  - Reviewed data from survey of all NC maternity hospitals about current policies/protocols for OB hemorrhage, severe HTN and VTE
- Monthly phone conferences and face-to-face meetings every 3-4 months to monitor progress

Perinatal Quality Collaborative of North Carolina



## The Partnership Needs You

- We need obstetricians to help to help engage all the maternity hospitals in the states
- Before you leave today please seek out and speak to one of us
  - John Allbert
  - Kate Menard
  - Arthur Ollendorff

Perinatal Quality Collaborative of North Carolina



## Shameless Plug For Breakout Session

- Green Data: Moving from Data Collection to Quality Improvement
  - “Green Data”
    - Readily available clinical or administrative data
- We will discuss simple techniques to allow you to focus on bedside quality improvement and not data collection

Perinatal Quality Collaborative of North Carolina



## FETAL ALCOHOL SPECTRUM DISORDERS (FASDs)

### An Ounce of Prevention

2016 Annual Meeting of the North Carolina Obstetrical & Gynecological Society  
Greensboro, NC

**Amy Hendricks, Coordinator**  
NC Fetal Alcohol Prevention Program  
FASDinNC.org  
Mission's Fullerton Genetics Center  
Asheville, NC  
828-213-0035  
amy.hendricks@msj.org



## History of Raising Awareness

### 2005

"When a pregnant woman drinks alcohol, so does her baby. Therefore, it's in the child's best interest for a pregnant woman to simply not drink alcohol." – U.S. Surgeon General Richard H. Carmona, 2005

### 2008

The American Congress of Obstetricians and Gynecologists (ACOG) states that children exposed to alcohol in utero are at risk for growth deficiencies, facial deformities, central nervous impairment, behavioral disorders, and impaired intellectual development.

### 2015

The American Academy of Pediatrics (AAP) identifies prenatal exposure to alcohol as the leading preventable cause of birth defects and intellectual and neurodevelopmental disabilities in children.

FASDinNC.org  
Fullerton Genetics/Mission Health

## Scope of the Issue: Women and Alcohol Use

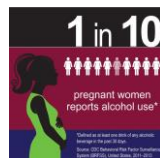
In February 2016, The Centers for Disease Control and Prevention (CDC) released the following:

More than 3.3 Million US women are at risk of exposing their developing baby to alcohol.

3 in 4 women who want to get pregnant as soon as possible report drinking alcohol

Among **pregnant women**, the highest estimates of reported alcohol use were among those who were:

- 35 – 44 years old
- College graduates
- Not married



2015–16 cdc.gov/vitalsigns

## Scope of the Issue: Alcohol

### North Carolina

#### Pregnant Women (18 – 44 years)

- 53.9% Drank alcohol three months prior to pregnancy.
- 7.5% Drank alcohol during the last three months of pregnancy.
- 13.1% Did not change their alcohol consumption from before pregnancy, during pregnancy.

#### Knowledge of Pregnancy:

- 46% (5 to 8 wks)      16.3% (9+ wks)

Source: NC PRAMS, 2011

## So Many Risk Factors...



## Goal: Healthy Birth Outcomes

Existing studies suggest that drinking during pregnancy may increase the risk of miscarriage, stillbirth, preterm delivery, and Sudden Infant Death Syndrome (SIDS).



<http://pubs.niaaa.nih.gov/publications/arh341/86-91.pdf>

## Substance Exposed Pregnancies

	Alcohol	Opioids, including Heroin	Marijuana	Tobacco	Cocaine
Subnormal IQ	x			x	
Developmental delays	x	No consensus	x	x	
Sensory deficits	x			x	
Fine motor deficits	x				
Attention deficits	x		x	x	No consensus
Hyperactivity	x			x	No consensus
Birth Defects	x			No consensus	
Neonatal withdrawal	x	x			
Prematurity	x	x		x	x

Behrke 2013

Insombrano et al. Report to Congress, US Department of Health and Human Services, 1994; Day et al.

## Impact of Alcohol Use



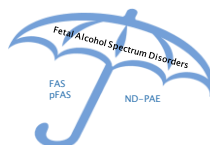
FASDinNC.org  
Fullerton Genetics/Mission Health

## FASDs: A Spectrum of Conditions

Fetal Alcohol Spectrum Disorders (FASDs):

A spectrum of conditions that can occur in an individual who exposed to alcohol during pregnancy. An individual can have a range of serious, lifelong problems which can include:

- Delayed Development
- Hyperactivity
- Intellectual and Learning Disabilities
- Executive Functioning Challenges
- Behavioral Problems



<http://www.nofas.org/recognizing-fasd/>

## Why Women Continue to Drink?

- Women are receiving mixed messages
  - Social Media/Media
  - Alcohol Industry
  - Support System/Peers
  - Primary Care Providers
- Lack of knowledge about alcohol & binge drinking
- Alcohol message/warning not being paired with life planning or birth control consult
- Limited signage warning pregnant women about the dangers of alcohol use. (ABC stores Only)

2015 odc.gov/vitalstats  
FASDinNC

## CDC Recommendations

### Women of Childbearing Age

If you are sexually active and drink alcohol, use an effective, consistent method of birth control.

If you are trying to get pregnant, don't drink.

If you are pregnant, don't drink.

**No Safe Type, No Safe Amount, No Safe Time**

FASDinNC.org  
Fullerton Genetics/Mission Health

## Your Call to Action

- Take the opportunity to talk about alcohol use with all women of childbearing age!
- Pair the alcohol message with any discussions related to life planning/pregnancy prevention.
- Identify resources that can help you have these discussions with women.  
<http://www.cdc.gov/ncbddd/fasd/alcohol-screening.html>  
<http://ncsbirt.org/sbirt-clinical-tools/>  
<http://www.integration.samhsa.gov/clinical-practice/sbirt>

38

## Resources

- [www.FASDinNC.org](http://www.FASDinNC.org)
- [www.cdc.gov/VitalSigns/Fasd/infographic.html](http://www.cdc.gov/VitalSigns/Fasd/infographic.html)
- [www.nofas.org](http://www.nofas.org)
- [www.womenandalcohol.org](http://www.womenandalcohol.org)
- [www.fasdcenter.samhsa.gov](http://www.fasdcenter.samhsa.gov)
- [www.aap.org](http://www.aap.org)
- [www.acog.org](http://www.acog.org)
- [www.everywomansoutheast.org](http://www.everywomansoutheast.org)
- [www.marchofdimes.org/northcarolina](http://www.marchofdimes.org/northcarolina)
- [www.mothers-to-baby.org](http://www.mothers-to-baby.org)
- [www.thearc.org/FASD-Prevention-Project](http://www.thearc.org/FASD-Prevention-Project)

## An Ounce of Prevention is Worth a Pound of Cure

— Benjamin Franklin



FASDs is 100% Preventable!

Thank you!



Electrosurgery in Gynecology

Keith H. Nelson, MD

April 10, 2016

North Carolina Obstetric and Gynecologic Society  
Greensboro, NC

At the conclusion, the participant will...

- Understand and apply safety concepts when using electrosurgery
- Differentiate between different surgical energy sources and select them appropriately
- Identify situations that put patients at risk for electrosurgical injury

Disclosures

- None

Acknowledgements

- Association of Professors of Gynecology and Obstetrics (APGO) Electrosurgical Scholars Program
  - Now the APGO Surgical Scholars Program
- Educational materials used with permission


The Father of Electrosurgery

- William T. Bovie (1882 – 1958)
  - Doctorate in plant physiology
  - Developed the electrosurgical generator for use in human surgery
  - First use October 1, 1926 to remove a mass from a patient’s head by Dr. Harvey Cushing
  - In later life, lived alone, and died believing he failed to make a difference in the world
  - Sold the patent for the electrosurgical generator for one dollar

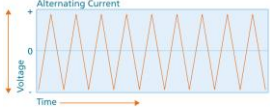
Fundamentals and Biophysics of Electricity

Two Types of Electrical Current

Direct (DC)



Alternating (AC)



Fundamentals and Biophysics of Electricity

Current (I)  
Resistance (R)  
Voltage (V)

Fundamentals and Biophysics of Electricity

A completed circuit must be present in order for electrons to flow

Fundamentals and Biophysics of Electricity

**Electricity Is Governed by Ohm’s Law:**  
 $V \text{ (voltage)} = I \text{ (current)} \times R \text{ (resistance/impedance)}$

Fundamentals and Biophysics of Electricity

**Power Is Expressed by the Equation:**  
 $W = I \times V$

Fundamentals and Biophysics of Electricity

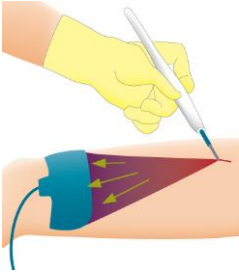
- So  
 $V = I \times R$   
 $W = I \times V$   
 $W = I \times I \times R = I^2 \times R$   
and also  $= V^2 / R$

Fundamentals and Biophysics of Electricity

**Frequency Spectrum**

Electrosurgery utilizes high-frequency alternating current in the radiofrequency range

Electrosurgery



Electrosurgery is accomplished by generation and delivery of high-frequency alternating current between an active electrode, through living tissue, and to a return electrode

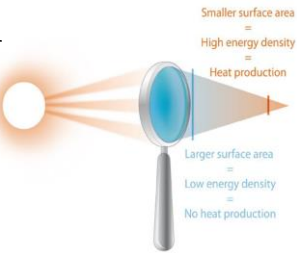
STOP SAYING CAUTERY!!!

Electrocautery is ***not*** electrosurgery



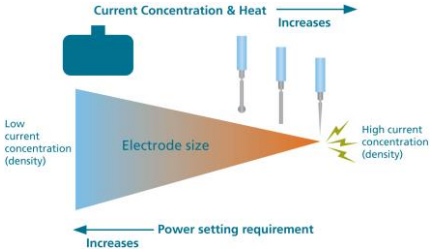
Current Density

- Manipulating current density determines whether coagulation or cutting predominates
- Coagulation occurs when larger electrode surface area is used
- Smaller electrode surface results in cutting or vaporization



Smaller surface area = High energy density = Heat production  
Larger surface area = Low energy density = No heat production

Current Density

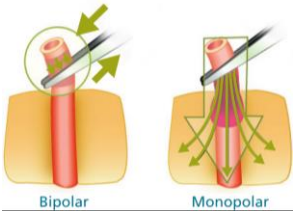


Current Concentration & Heat Increases  
Electrode size  
Low current concentration (density) → High current concentration (density)  
Power setting requirement Increases

Current density is moderated by electrode surface area

Bipolar and Monopolar Electrosurgery

Tissue vs. Patient

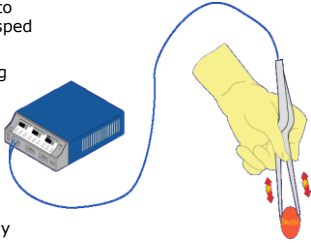


Bipolar      Monopolar

All electrosurgery is intrinsically bipolar due to the use of alternating current

Bipolar Electrosurgery

- Effects applied only to the tissue being grasped
- Reliable method of occluding and sealing blood vessels
- Produces less smoke
- Works well under saline or non-electrolyte solutions
- Thermal damage may still occur



Monopolar Electrosurgery

The larger surface area and substantially lower current density at the dispersive electrode site preclude tissue heating sufficient to burn

Monopolar Electrosurgery

- Low 70-watt maximum power output
- Low (less than 1 amp) current
- Low voltage: 320-1,200 volts
- Greater range of tissue effects
- Increased potential for undesired burns and stray currents
- Self-limiting: 100-Ohm load
- Continuous or interrupted waveforms

Electrosurgical Waveforms  
Cut, Blend, and Coag

- Alternating current used for electrosurgery is a sinusoidal waveform, constantly changing directions
- Waveforms produced by an ESU range from the continuous low-voltage *cut* output to the discontinuous high-voltage *coag* output, providing outputs of varying current and voltage
- *cut*, *blend*, and *coag* do not refer to literal tissue effects

Electrosurgical Waveforms  
Cut

Pure *cut* is an uninterrupted sine wave of low voltage. Compared to the other outputs, the average current is the highest and the peak voltage is lowest

Electrosurgical Waveforms  
Blend

**Blend** refers to a blend of the net surgical effects of tissue cutting and coagulation, not a literal blend of different types of electrosurgical current outputs

Electrosurgical Waveforms  
Coag

The pure **coag** waveform is highly interrupted with frequent and prolonged gaps

Electrosurgical Waveforms  
Bipolar Electrodesurgery

Low Voltage                      High Voltage

cut    blend 1    blend 2    blend 3    coag

100% on    50% on 50% off    40% on 60% off    25% on 75% off    6% on 94% off

- The option to choose coagulation or cutting current during **bipolar** electrotherapy was present on older ESUs but is no longer offered
- CREST study – monopolar coagulation of fallopian tubes was less prone to failure than bipolar electrotherapy

Electrosurgical Tissue Endpoints

Cutting = Vaporization

Fulguration

Desiccation = Coagulation

Non-Contact Phenomena

blend

cut    coag

>200 Volts

Active Electrode

Ionized Gas

Tissue

Non-Contact Phenomena

cut    blend    coag

Low    Thermal Spread/Charring    High

Low    Voltage    High

Non-Contact Phenomena

Fulguration is the use of high-voltage sparking produced by **coag** current to coagulate a broad surface

Contact Phenomena  
Desiccation and Coagulation

A.    B.

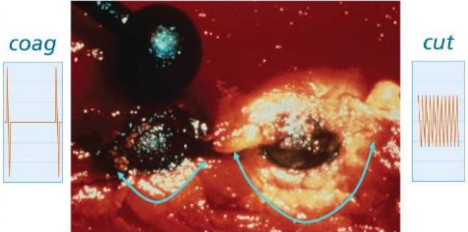
- Desiccation and coagulation can occur whenever an activated electrode comes into direct contact with tissue for a sufficient amount of time. Desiccation occurs as cells become dehydrated but still preserve their form.
- Tissue can be desiccated with either the *cut* waveform (A) or the *coag* waveform (B). The cut mode results in great heat penetration and less charring.
- Eschar buildup can occur.

Contact Phenomena

Desiccation and Coagulation

coag

cut




Tissue Effects - Summary

Method	Electrosurgical Waveform	
	Cutting	Coagulation
Non-contact	Vaporization	Fulguration
Contact	Coagulation (Desiccation) [deep]	Coagulation (Desiccation) [shallow]

Safety

Reducing Risk During Conventional and Laparoscopic Electrosurgery

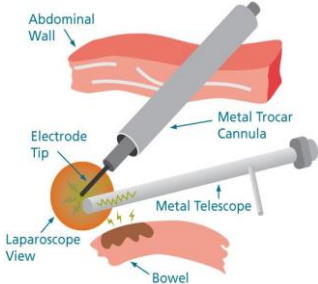
Electrosurgical Burns



- Two-thirds of electrosurgical burns result from improper application of electrode
- Potentially unintended current pathways to the ground include the operating room table, metal stirrups, EKG leads, and the surgeon
- Because most of the conductors, including part of active electrode, are out of the surgeon's view, some injuries – eg, to the bowel – may not be recognized immediately
- Prevention of such complications is critical

Reducing Risk During Conventional and Laparoscopic Electrosurgery

Direct Coupling



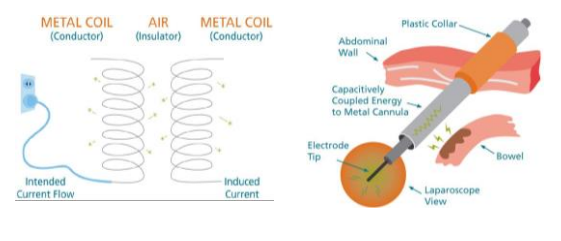
Reducing Risk During Conventional and Laparoscopic Electrosurgery

Capacitance

- Capacitance is the property of an electrical circuit to store energy.
- Capacitive coupling occurs primarily during endoscopic monopolar procedures. It is not a risk during bipolar electrosurgical procedures.
- The amount of capacitance is directly proportional to the voltage (ie, lowest with the *cut* and highest with the *coag* waveforms).

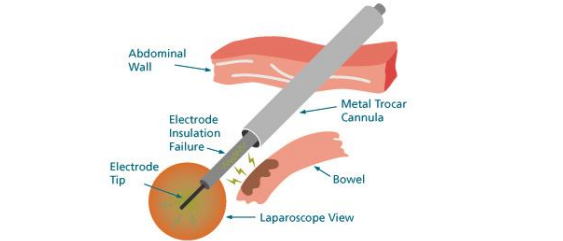
Reducing Risk During Conventional and Laparoscopic Electrosurgery

Capacitive Coupling



Reducing Risk During Conventional and Laparoscopic Electrosurgery

Insulation Failure



Insulation Failures

- One in five reusable instruments had an insulation failure identifiable, usually in the distal third
  - Surgical Endoscopy 24(2):462-5, 2010
- Robotic instruments were more likely (80% versus 36%) to have insulation failures present that laparoscopic instruments, usually in the distal third
  - Am J Obstet Gynecol [Epub] 2011

Reducing Risk During Conventional and Laparoscopic Electrosurgery

Dispersive Electrode Site Placement

- Select well-vascularized muscle mass and avoid sites that can increase impedance such as irregular body contours, bony prominences, scar tissue, adipose tissue, and areas with excessive hair.
- Impedance can also be increased by fluid invasion. Choose a site close to the surgical field to ensure a short current pathway and lower power settings.
- Maintain full contact between the dispersive electrode and the tissue to help preclude current concentration and potential burns.

Reducing Risk During Conventional and Laparoscopic Electrosurgery

Body Jewelry

- The presence of jewelry and metal could lead to an inadvertent stray radiofrequency current injury
- If body jewelry cannot be removed prior to surgery, it should be taped in place with maximum surface area contact and covered with gauze to reduce the risk of current concentration, which can cause an inadvertent burn

Reducing Risk During Conventional and Laparoscopic Electrosurgery

Implanted Electronic Devices







## Conclusion

- Patient safety is paramount, yet one of the most commonly used tools in the operating room is poorly understood and counterintuitive in its mechanism, resulting in preventable injury to patients
- Patients are best served by the judicious use of electrosurgery by surgeons who understand its principles
- Electrosurgical systems are more sophisticated than they used to be, so surgeons must continue to understand the systems they use in order to provide safe patient care