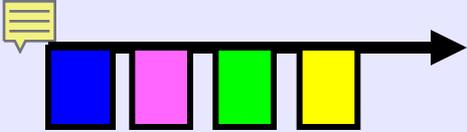


# The Perinatal Periods of Risk Approach

## Phase 1 analysis

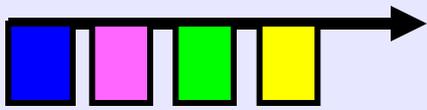




# Why do we need PPOR?

## Infant mortality is complex

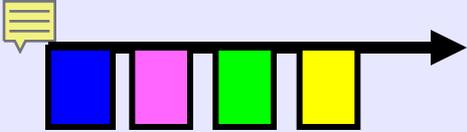
- Sensitive measure of a community's health
- Complex interweaving of a social & health problem
- Many contributors and risk factors
- Strong contributors and risk factors
- Small number of events in most communities
- Limited data and analytic capacity in most communities



# Communities needed help!

Dr. Bill Sappenfield, CDC's first assignee to CityMatCH, and Dr. Magda Peck, founder of CityMatCH, teamed up!



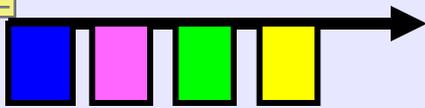


## OUR EXPERTS CONSULTED WITH THEIR EXPERTS

*Dr. Brian McCarthy and colleagues at the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) **knew that** causes of perinatal death are closely related to both **age at death** and **birth weight**.*



**Why not use both pieces of information to learn more about why babies are dying?**



# 6-stage PPOR approach following the community planning cycle

Stage 1: Assure Community and Analytic **Readiness**

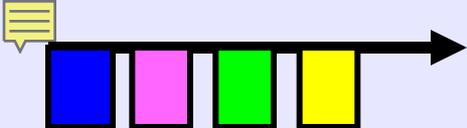
Stage 2: Conduct **Analytic** Phases of PPOR

Stage 3: Develop **Strategic Actions** for Targeted Prevention

Stage 4: Strengthen Existing and/or Launch **New Prevention Initiatives**

Stage 5: **Monitor** and Evaluate Approach

Stage 6: **Sustain** Stakeholder Investment and Political Will



# What IS this thing called PPOR Analysis?

Stage 1: Assure Community and Analytic Readiness

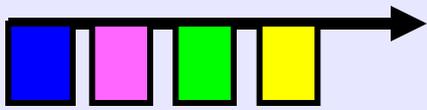
**Stage 2: Conduct Analytic Phases of PPOR**

Stage 3: Develop Strategic Actions for Targeted Prevention

Stage 4: Strengthen Existing and/or Launch New Prevention Initiatives

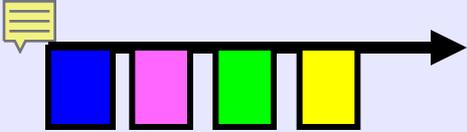
Stage 5: Monitor and Evaluate Approach

Stage 6: Sustain Stakeholder Investment and Political Will



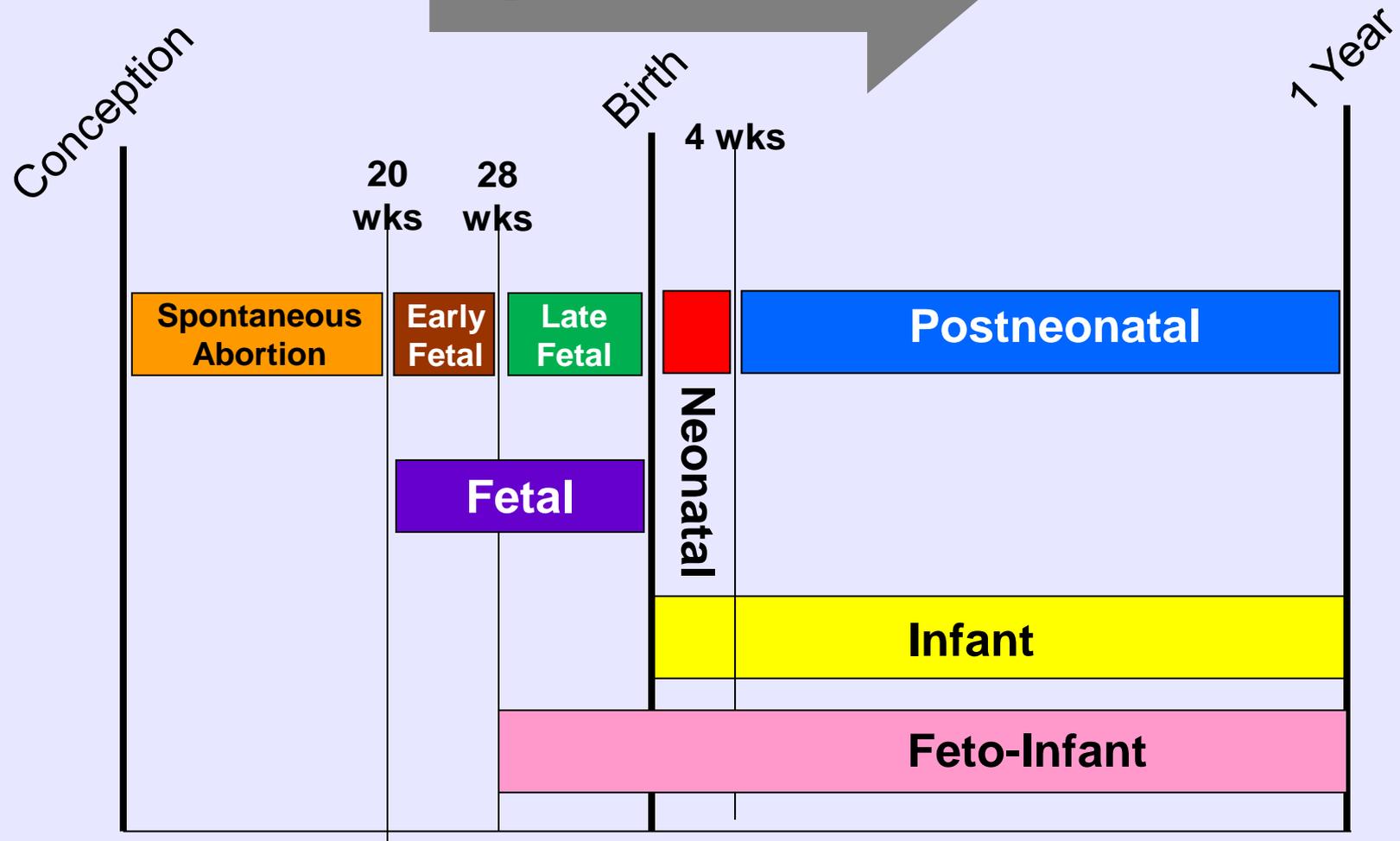
## PPOR analytic methods were constructed on existing infant mortality study methods.

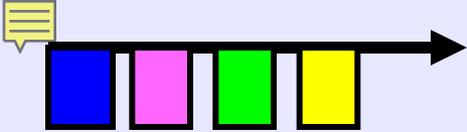
- Cause of death is closely related to both **age at death** and **birth weight**.
- We can use these two pieces of information to help us investigate the **causes of mortality** in communities



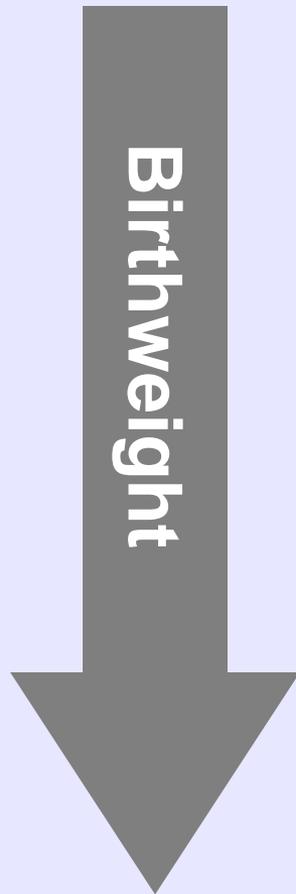
# First Dimension of PPOR Analysis

*Age at Death*

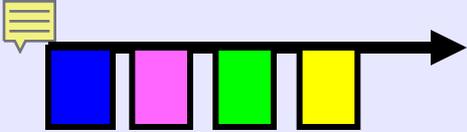




## Second Dimension: Birthweight

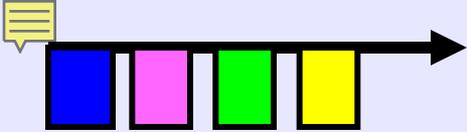


- **Extremely Low Birthweight**  
<1,000 grams (2.2 pounds)
- **Very Low Birthweight**  
<1,500 grams (3.3 pounds)
- **Low Birthweight**  
<2,500 grams (5.5 pounds)
- **Normal Birthweight**  
2,500 grams or more (5.5 pounds)



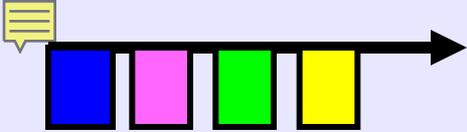
# World Health Organization Periods of Risk “map”

	Fetal Deaths	Early Neonatal	Late Neonatal	Post neonatal
500-999 g	1	2	3	4
1000-1499 g	5	6	7	8
1500-2499 g	9	10	11	12
2500+ g	13	14	15	16

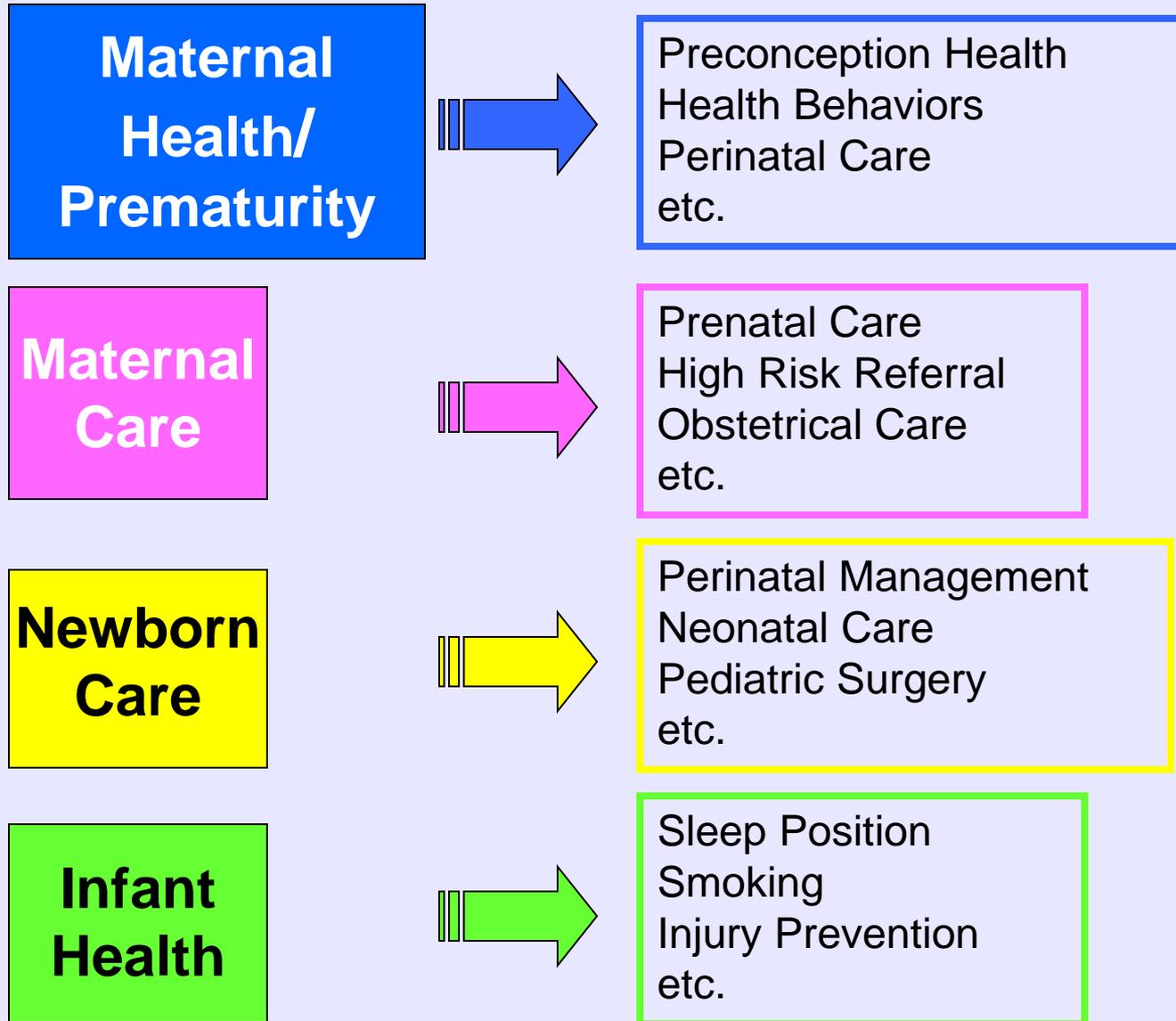


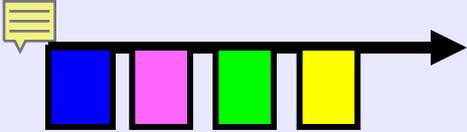
# Simplifying the WHO Model to create the PPOR Map

	Fetal Deaths	Late Neonatal	Early Neonatal	Post neonatal
500-999 g	1	2	3	4
1000-1499 g	5	6	7	8
1500-2499 g	9	10	11	12
2500+ g	13	14	15	16
	Fetal Death ≥24 weeks	Neonatal 0-27 days	Post- neonatal 28-364 days	



# Phase 1 Narrows the Choices of Action





# PPOR Analytic Methods

## Analytic Preparation

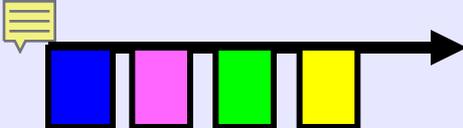
Acquire, assess, and process data files

## Phase 1 Analysis

Identifies the populations and periods of risk with the largest excess mortality

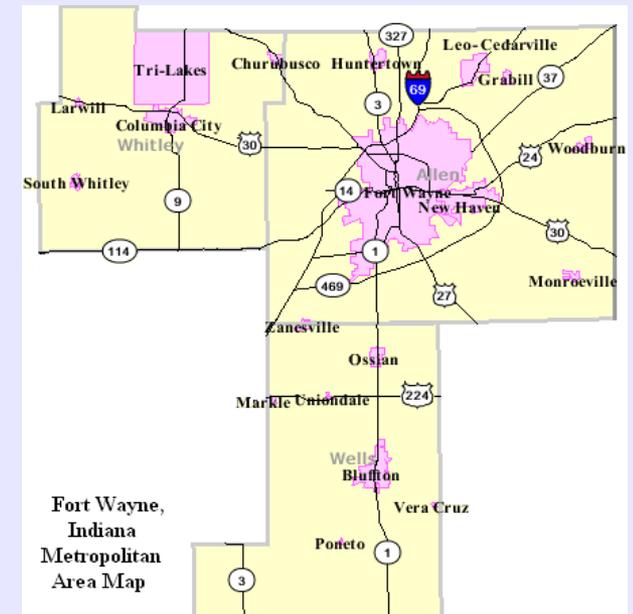
## Phase 2 Analysis

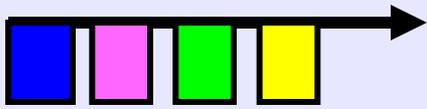
Explains why the excess deaths occurred and directs prevention efforts



# Define the study population

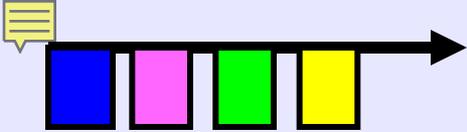
Include infants and fetal deaths whose mothers were residents of the study area at the time of the birth





## Steps of Data Preparation

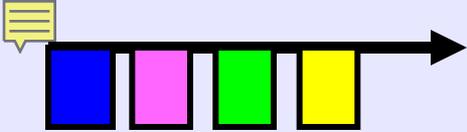
- Acquire and prepare vital records files for the defined study population
- Assess data quality
- Restrict study population by birthweight and gestational age
- Assess study sample size and re-define study population if needed



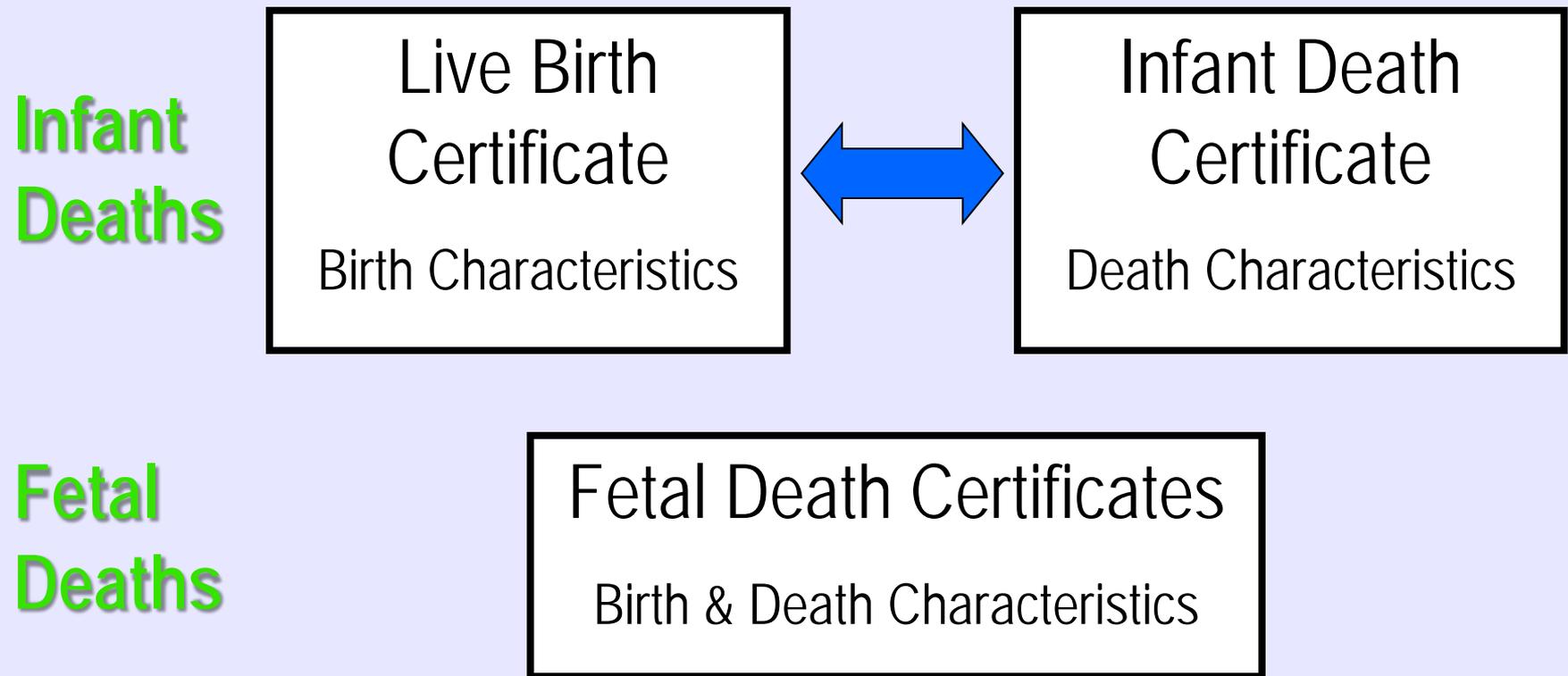
## Preparation of Data: Acquiring Three Data Files

- Live birth certificate files
- Fetal death certificate files
- Linked birth—infant death certificate files

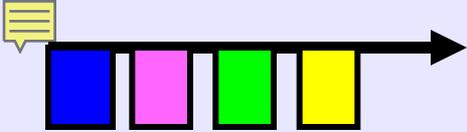
ALL are produced in every state, but sometimes difficult to obtain by local health departments



# Linked Birth & Infant Death Certificates

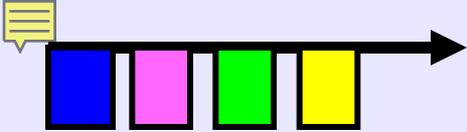


Note: *Spontaneous and induced abortions are NOT included*



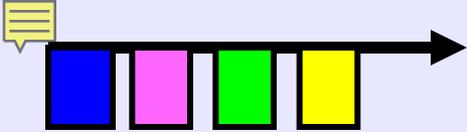
## Preparation of Data: Data Quality Checks

- Run frequencies
- Read the code book (variable definitions and value labels)
- Compute counts for the missing values (in SAS, use **/missing** )
- Check for implausible data and other errors



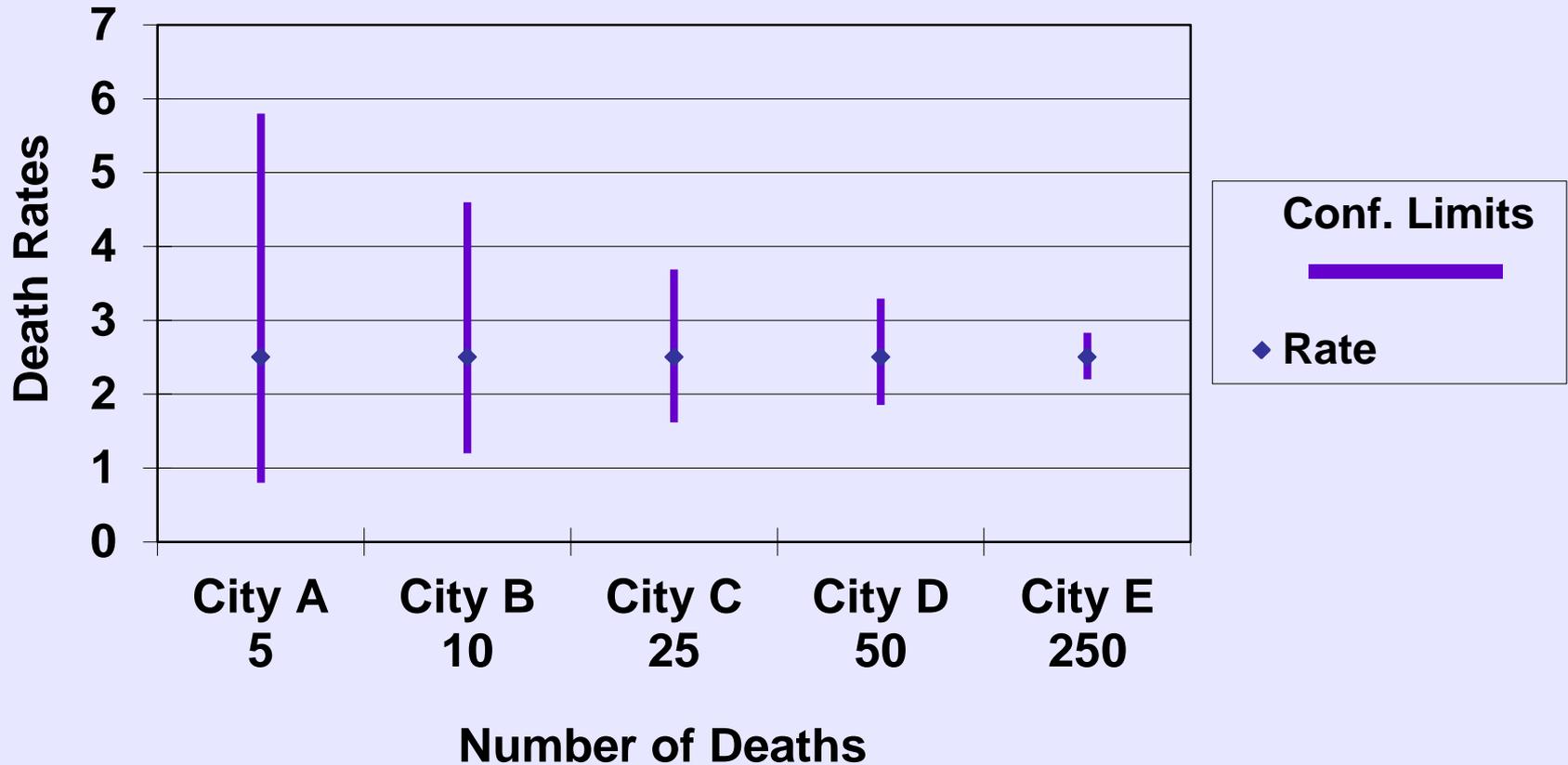
## Preparation of Data: Minimum Number of Deaths

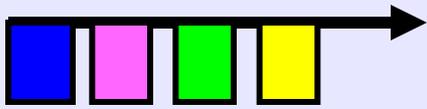
- At least sixty deaths overall and/or at least ten deaths in each period of risk, for each population being studied
- May combine up to 5 years to reach adequate number of deaths (no more, due to changes in medical practice and community characteristics)
- May combine geographic areas to reach adequate number of deaths (areas are meaningful)
- Phase 2 analyses require even more deaths.



# Why at least 60 deaths?

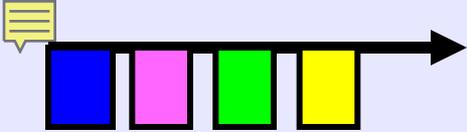
## 95% Confidence Limits for Mortality Rates by Number of Deaths





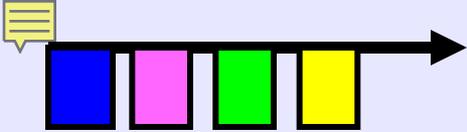
# Preparation of Data

- Preparing data can take significant time
- Depends on staff experience and expertise
- Essential before going on to Phase 1 analysis



## Steps of PPOR Phase 1 Analysis

- **Calculate numbers and rates for the fetal-infant mortality map**
- Make fetal-infant mortality maps for different time periods, subpopulations and geographic areas
- Select reference populations (and make a fetal-infant mortality map)
- Calculate excess mortality and identify opportunity gaps



# Sort the fetal and infant deaths into the PPOR Map

Age at Death

Fetal Death  
≥24 weeks

Neonatal  
0-27 days

Post-neonatal  
28-364 days

500-1499 g

Maternal Health/  
Prematurity

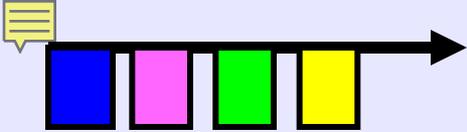
1500+ g

Maternal  
Care

Newborn  
Care

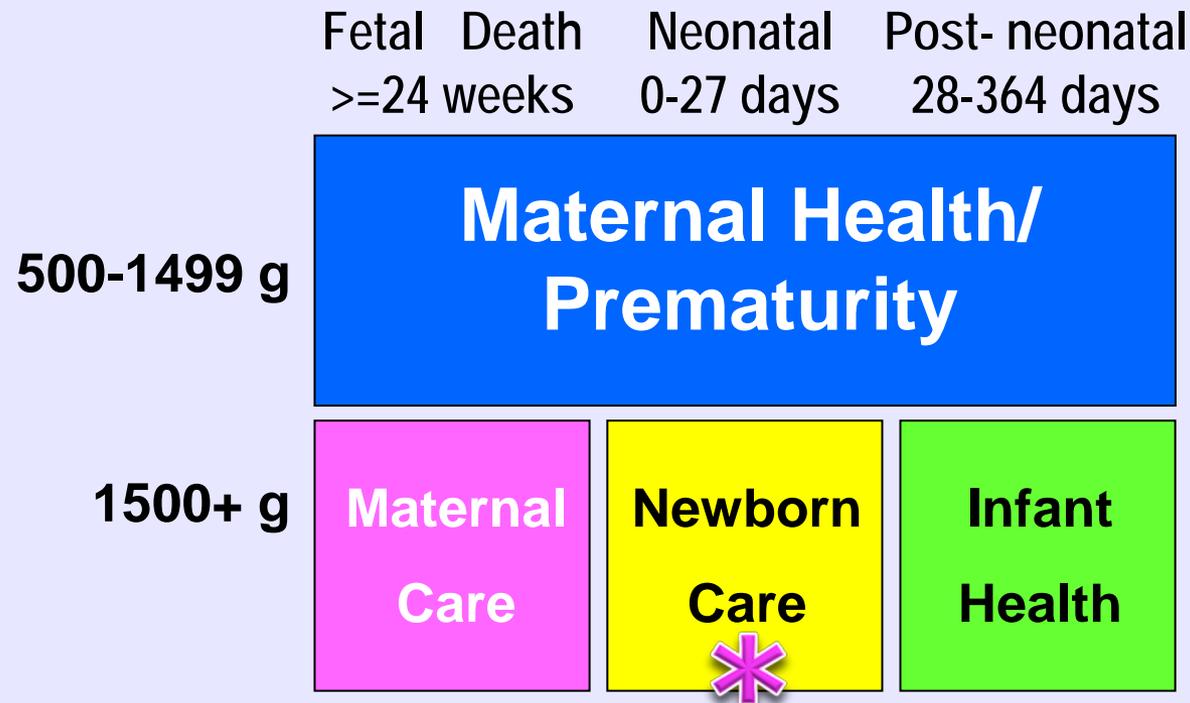
Infant  
Health

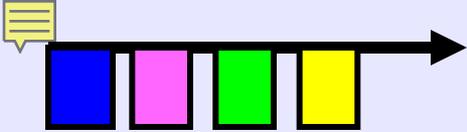
Birthweight



# **SORT the Fetal and Infant Deaths**

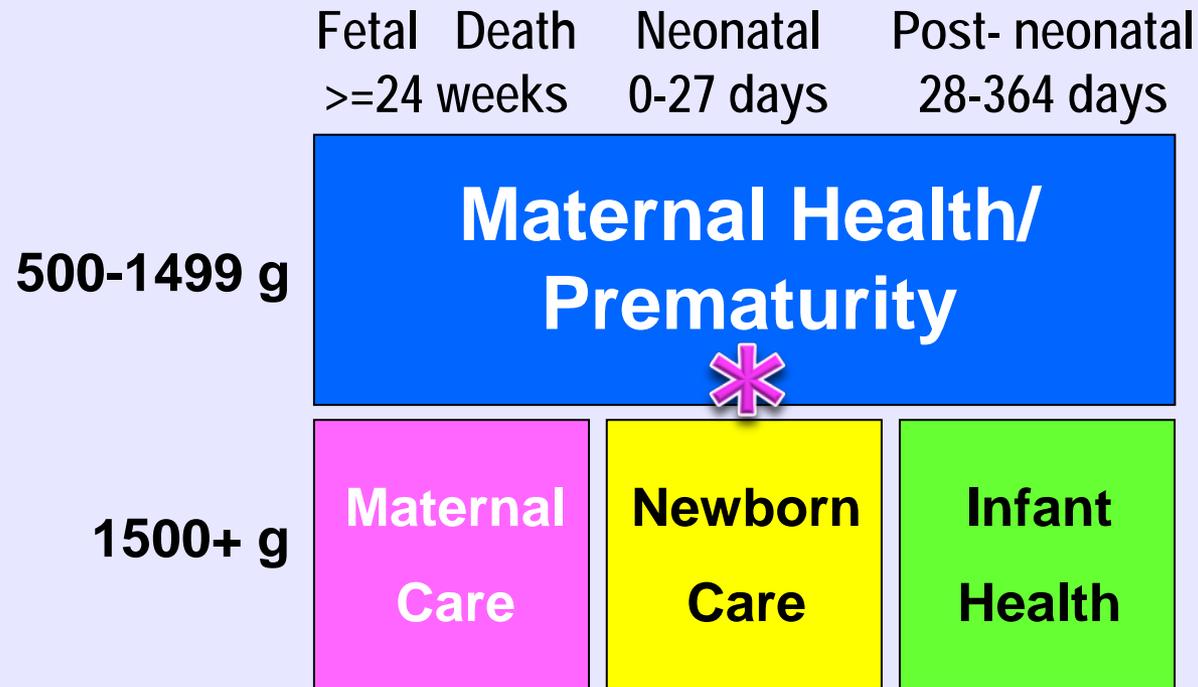
**\*Example:** Infant death--2499g & 22 days old

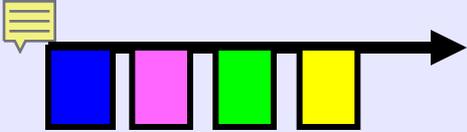




# **SORT the Fetal and Infant Deaths**

**\*Example: fetal death--820g**



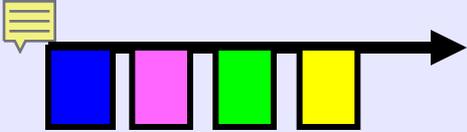


# **SORT the Fetal and Infant Deaths**

**\* Example: live birth--480g & <1 day**

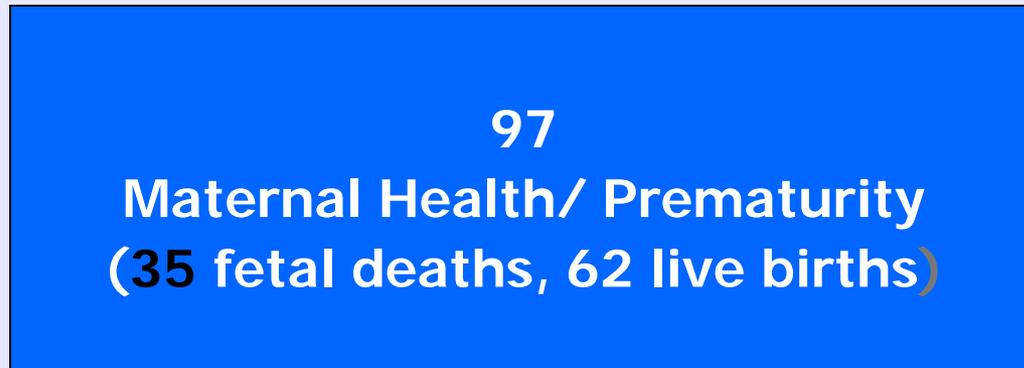


	Fetal Death >=24 weeks	Neonatal 0-27 days	Post- neonatal 28-364 days
500-1499 g	<b>Maternal Health/ Prematurity</b>		
1500+ g	<b>Maternal Care</b>	<b>Newborn Care</b>	<b>Infant Health</b>



# PPOR Map of Fetal-Infant Deaths

## Urban County



$$35 + 48$$

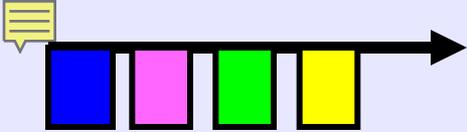
= 83 Fetal Deaths



$$97 + 48 + 44 + 47$$

= 236 Total deaths

23,199 Live Births



# Calculating Fetal-Infant Mortality Rate

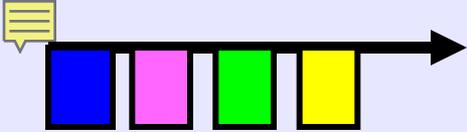
Urban County

Formula:

Rate = deaths  $\times$  1,000  $\div$  denominator

The denominator is the population at risk

**83 Fetal Deaths + 23,199 Live Births**  
**=23,282**



# Calculating Fetal-Infant Mortality Rate

## Urban County

$$97 \text{ deaths} \times 1,000 \div 23,282 = 4.17$$

$$48 \times 1,000 \div 23,282 = 2.06$$

$$44 \times 1,000 \div 23,282 = 1.89$$

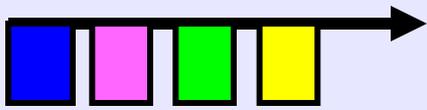
$$47 \times 1,000 \div 23,282 = 2.02$$

Period rates add up to overall rate

$$4.17 + 2.06 + 1.89 + 2.02$$

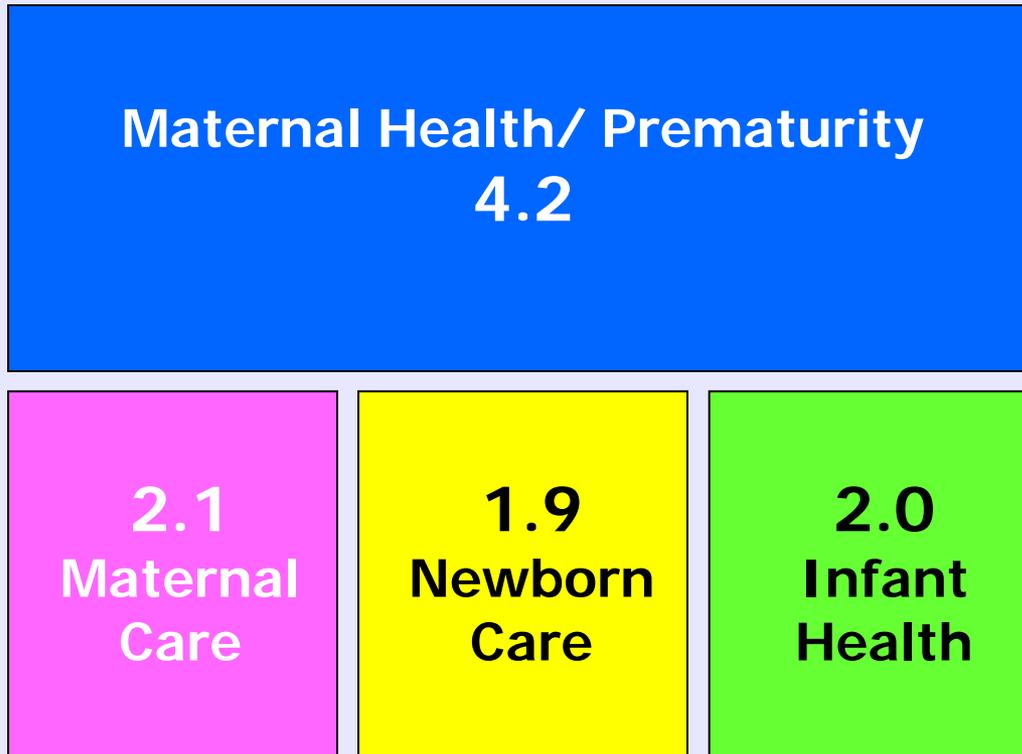
$$= 10.14$$

$$\text{Overall rate} = 236 \times 1,000 \div 23,282 = 10.14$$



# PPOR Map of Fetal-Infant Mortality Rates

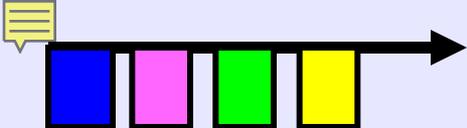
## Urban County



Overall Rate

= 10.1

Fetal and Infant  
Deaths per  
thousand



## Steps of PPOR Phase 1 Analysis

- Calculate numbers and rates for the fetal-infant mortality map
- **Make fetal-infant mortality maps for different time periods, subpopulations and geographic areas**
- Select reference populations (and make a fetal-infant mortality map)
- Calculate excess mortality and identify opportunity gaps

# Urban County: Comparing Different Time Periods

Fetal-Infant  
Rate=10.7



1993-1996

Fetal-Infant  
Rate=10.3



1997-2000

Fetal-Infant  
Rate=8.8

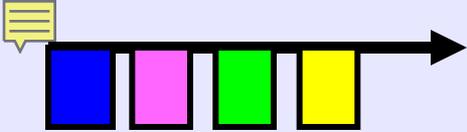


2001-2005

Fetal-Infant  
Rate=8.2



2006-2009



# Urban County: Comparing Different Subpopulations

White Fetal-Infant  
Rate = 8.6

(Denom. = 16,045)



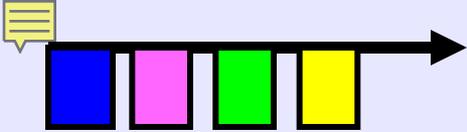
White non-Hispanic

Black Fetal-Infant  
Rate = 17.6

(Denom. = 3,291)



Black non-Hispanic

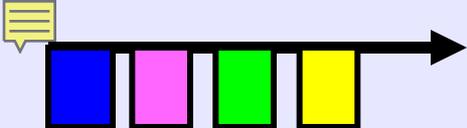


## Urban County: Comparing Different Subpopulations

Seeing disparities like this makes the community begin to ask questions such as

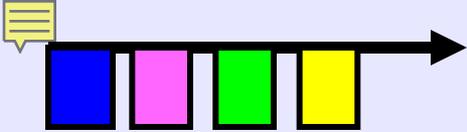
*“If one group can experience good outcomes, why can’t all groups?”*

PPOR formalizes this question and suggests ways to find answers.



## Steps of PPOR Phase 1 Analysis

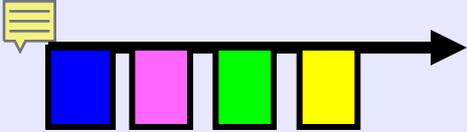
- Calculate numbers and rates for the fetal-infant mortality map
- Make fetal-infant mortality maps for different time periods, subpopulations and geographic areas
- **Select reference populations (and make a fetal-infant mortality map)**
- Calculate excess mortality and identify opportunity gaps



# PPOR Uses a Reference Group



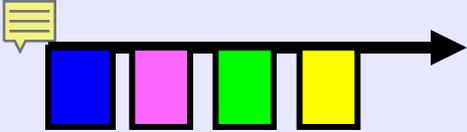
- Our assumption is that if one population group can have low mortality, other groups can reach that goal.
- Instead of comparing racial/ethnic groups, we compare all groups to this agreed-upon reference group.



## Reference Group

- It should have better or optimal pregnancy outcomes.
- In general, this group should represent roughly 15% or more of the population.
- It needs to have at least 60 deaths.
- **The community should be involved!!!**





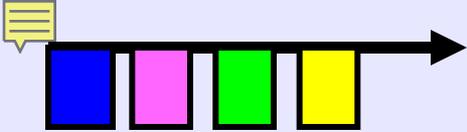
# Reference Group

## Internal

- A subgroup from the area under study

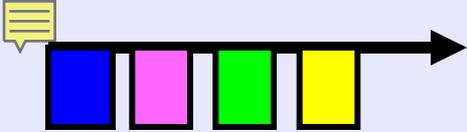
## External

- State
- Similar city
- National reference group



# Potential Reference Groups

- Non-Hispanic White Mothers age 20 or older, with 13 or more years of education, residents of the city at the time of baby's birth
- Asian or Hispanic mothers
- Black mothers with 13 or more years of education



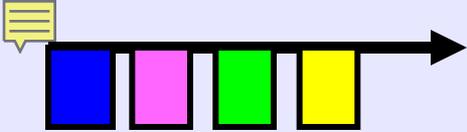
# USA Reference Group 2000-2002

Defined by *maternal* characteristics

- 20 or more years of age
- 13 or more years of education
- Non-Hispanic white women
- residents of the US at the time of baby's birth

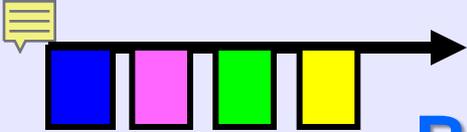


**Total Fetal-  
Infant  
Mortality  
Rate = 5.7**



# Steps of PPOR Phase 1 Analysis

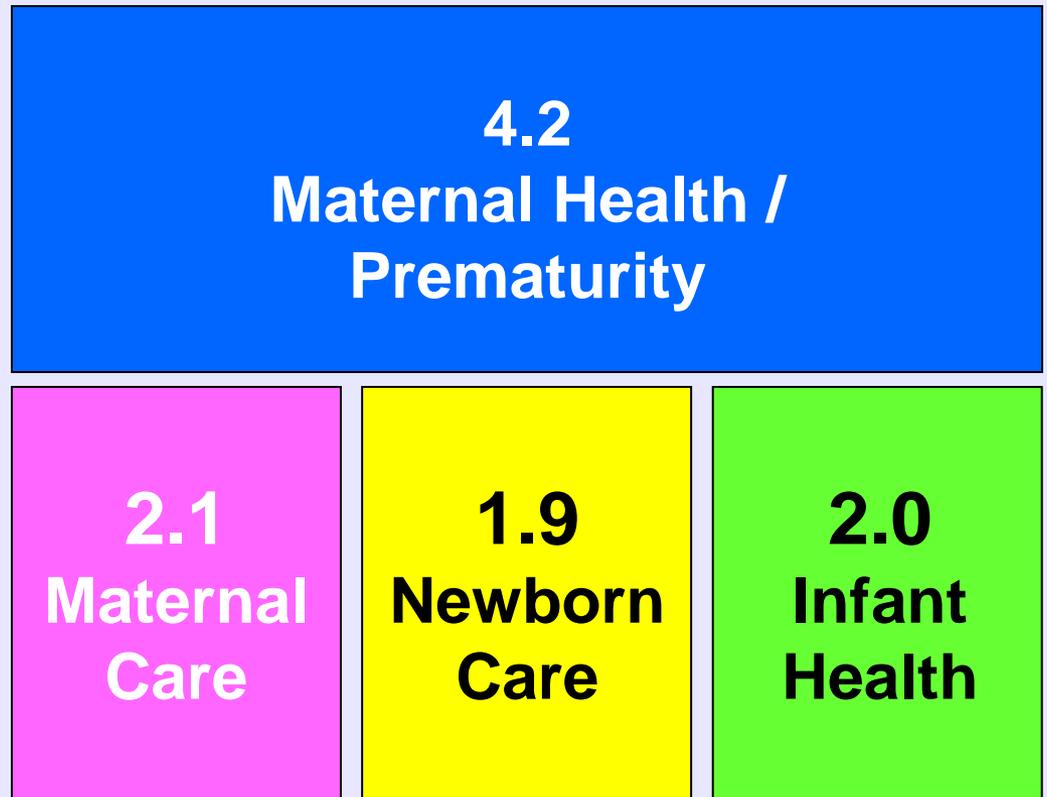
- Calculate numbers and rates for the fetal-infant mortality map
- Make fetal-infant mortality maps for different time periods, subpopulations and geographic areas
- Select reference populations (and make a fetal-infant mortality map)
- **Calculate excess mortality and identify opportunity gaps**

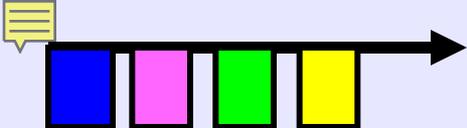


## Back to Urban County Example

... **What we had done so far** ...

**Overall Fetal-Infant Mortality Rate = 10.1**





# Calculating Excess Rates

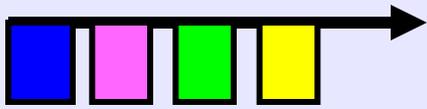
(Urban County vs USA 2000-2002 Reference Group)

Urban County	Maternal Health/ Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
ALL	4.2	2.1	1.9	2.0	10.1

USA Reference Group	2.2	1.5	1.1	0.9	5.7
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Excess Mortality Rates	2.0	0.6	0.8	1.1	4.4
------------------------	-----	-----	-----	-----	-----



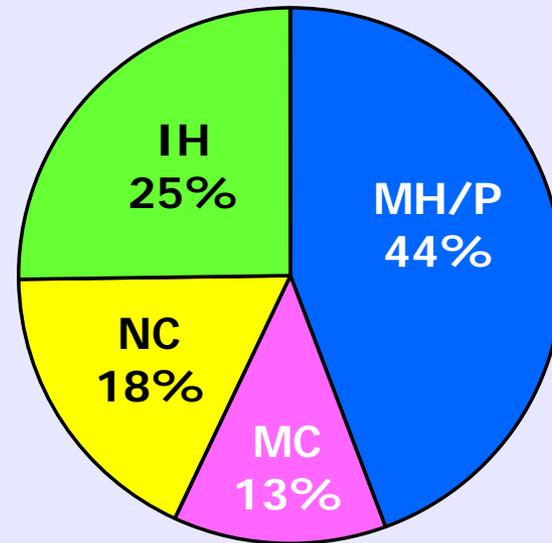
# Displaying EXCESS Mortality

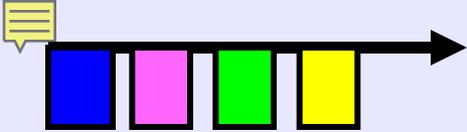
(Urban County vs USA 2000-2002 Reference Group)

**EXCESS**  
**Fetal-Infant Mortality Rate**  
**4.4**



**Excess Mortality**

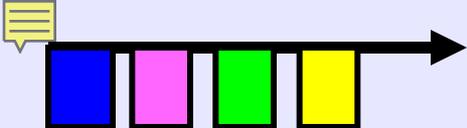




# Fetal-Infant Mortality Rates by Race/Ethnicity

(Urban County vs USA 2000-2002 Reference Group)

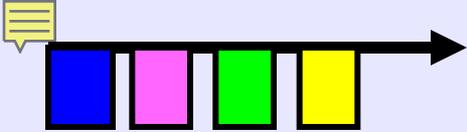
Racial Groups	Maternal Health/ Prematurity	Maternal Care	Newborn Care	Infant Health	Overall Fetal-Infant Mortality
White, non-Hispanic	3.1	2.0	1.9	1.6	8.6
Black, non-Hispanic	8.8	2.4	2.4	4.0	17.6
Hispanic and other races	4.6	2.0	1.3	2.3	10.2
<b>USA Reference Group</b>	<b>2.2</b>	<b>1.5</b>	<b>1.1</b>	<b>0.9</b>	<b>5.7</b>



# Excess Fetal-Infant Mortality Rates

(Urban County vs USA 2000-2002 Reference Group)

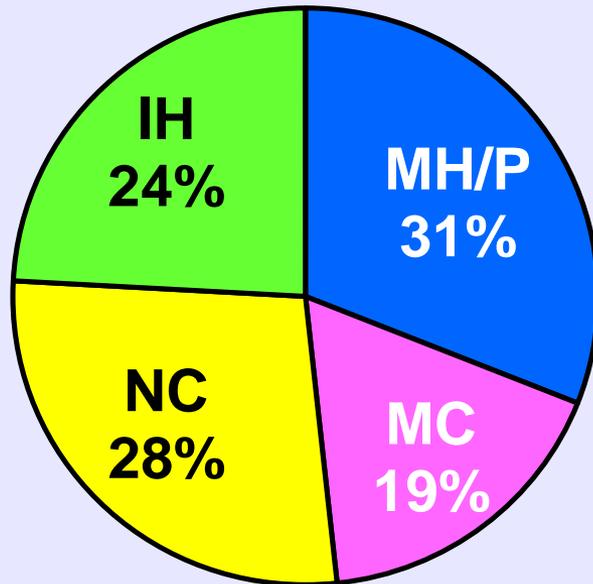
Racial/ Ethnic Groups	Maternal Health/ Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
White, non- Hispanic	0.9	0.5	0.8	0.7	2.9
Black, non- Hispanic	6.6	0.9	1.3	3.1	11.9
Other Races	2.4	0.5	0.2	1.4	4.5
All	2.0	0.6	0.8	1.1	4.4



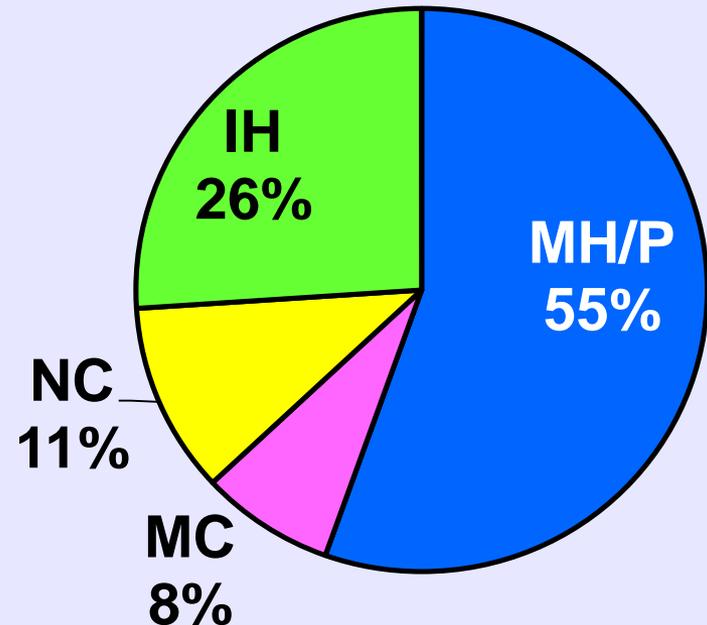
# EXCESS Mortality

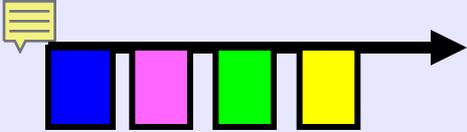
(Urban County vs USA 2000-2002 Reference Group)

## White Excess Mortality



## Black Excess Mortality

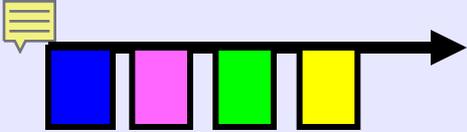




**CALCULATING *EXCESS NUMBER OF DEATHS* FROM  
Fetal-Infant Mortality Rates  
(Urban County vs USA 2000-2002 Reference Group )**

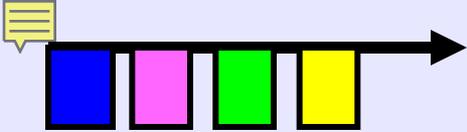
**Formula:**

$$\begin{aligned} &\text{estimated number of excess deaths} \\ &= \text{excess rate} * \text{denominator} \div 1,000 \end{aligned}$$



# CALCULATING *EXCESS NUMBER OF DEATHS* FROM Fetal-Infant Mortality Rates (Urban County vs USA 2000-2002 Reference Group)

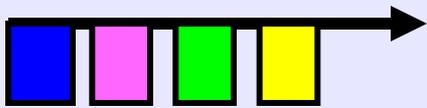
Racial/ Ethnic Group	Overall Excess Mortality Rate	Live Births and Fetal deaths	Multiply	Number of Excess Deaths
White Non-Hispanic	2.9	16,045	$\frac{2.9 \times 16,045}{1,000}$	47
Black Non-Hispanic	11.9	3,291	$\frac{11.9 \times 3,291}{1,000}$	39
Other Race	4.5	3,947	$\frac{4.5 \times 3,947}{1,000}$	18
All	4.4	23,282	$\frac{4.4 \times 23,282}{1,000}$	103



# Estimated *Excess Number of Deaths*

(Urban County vs USA 2000-2002 Reference Group )

Racial/Ethnic Groups	Maternal Health/ Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
White, non-Hispanic	14	8	13	11	47
Black, non-Hispanic	22	3	4	10	39
Other Races	9	2	1	6	18
All	46	13	18	26	103

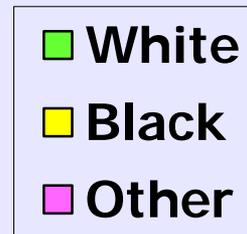
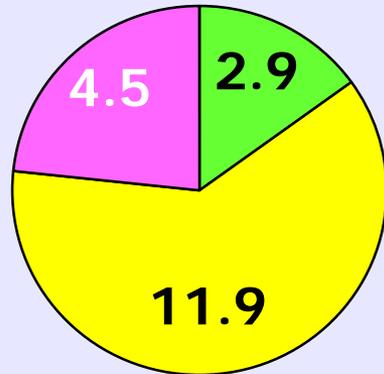


# Rates and Numbers

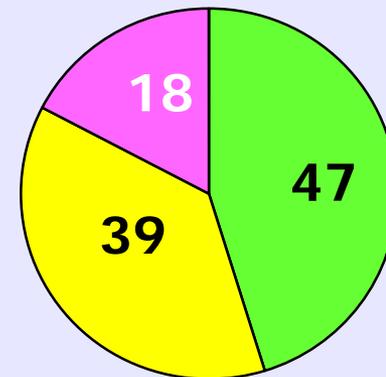
## Can Tell Different Stories

(Urban County vs USA 2000-2002 Reference Group )

### Excess Rates

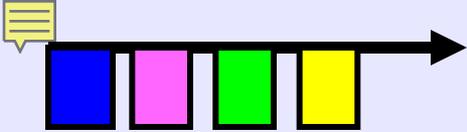


### Excess Numbers

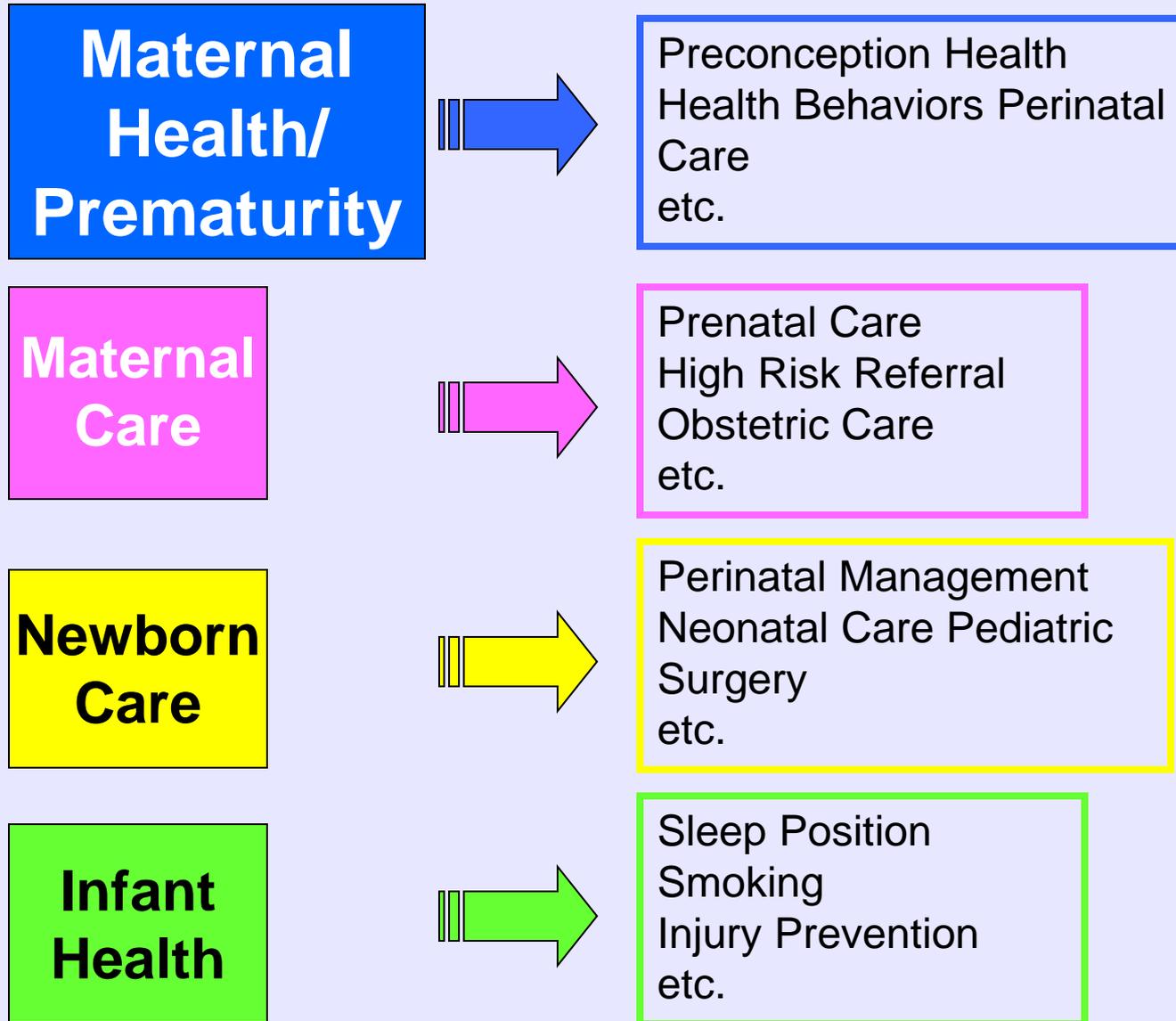


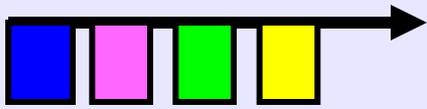
### How do we choose?

- Large differences in rates can point to “low hanging fruit”
- Large numbers can show overall “burden”



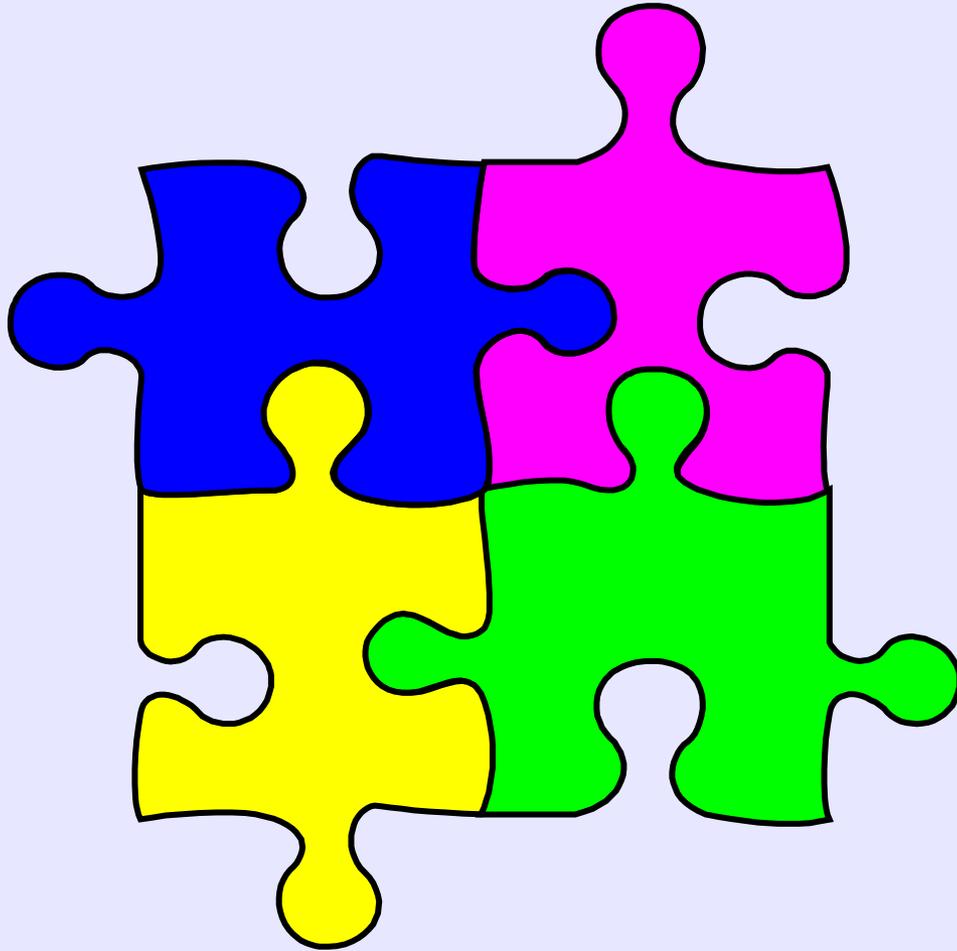
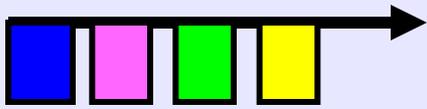
# Phase 1 Narrows the Choices of Action





Phase 1 is NOT enough.

Phase 2 analyses are **REQUIRED** to determine which **RISK FACTORS** are most important in **YOUR COMMUNITY...**



**PPOR Phase 1:**  
**EXERCISE**