



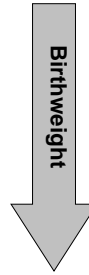
The Perinatal Periods of Risk Approach

Phase 1 Analysis

Objective: Participants will be able to conduct the first phase of analysis



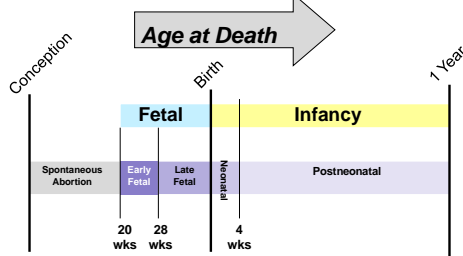
Cause of death is related to birthweight



- ◆ Extremely Low Birthweight (PPOR limit) = less than 1,000 grams (2.2 pounds)
- ◆ Very Low Birthweight (PPOR limit) = less than 1,500 grams (3.3 pounds)
- ◆ Low Birthweight = less than 2,500 grams (5.5 pounds)
- ◆ Normal Birthweight = 2,500 grams or larger
 - ◆ a 7.5-pound baby weighs 3,400 grams



Cause of death is related to age at death



World Health Organization Periods of Risk Matrix utilized birth weight and age at death at the same time

	Fetal Deaths	Early Neonatal	Late Neonatal	Post neonatal
500-999 g				
1000-1499 g				
1500-2499 g				
2500+ g				



Simplifying the WHO Matrix to create the PPOR Map (combine cells with similar causes, similar solutions)

	Fetal Deaths	Late Neonatal	Early Neonatal	Post neonatal
500-999 g				
1000-1499 g				
1500-2499 g				
2500+ g				

Fetal Death >=24 weeks
Neonatal 0-27 days
Post-neonatal 28-364 days



PPOR Analytic Methods

Data Preparation

Acquire, assess, and process data files

Phase I Analysis

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

Phase 2 Analysis

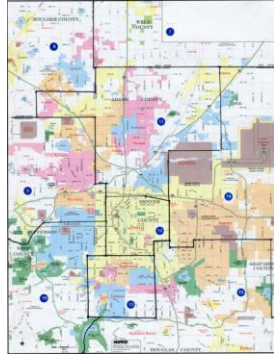
Explains why the excess deaths occurred and directs prevention efforts



Define the study population & timeframe

Need at least 60 births to residents in each group you want to study and in the reference group.

Phase 2 analysis needs 2 to 4 times more, depending on distribution of causes of death and level of analysis desired.



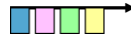
Preparation of Data --Acquiring Three Data Files--

- ◆ Live birth files (birth certificate)
- ◆ Fetal death certificate files
- ◆ Linked birth—infant deaths
- ◆ ALL are produced by every state, but they are sometimes difficult for local health departments to obtain.



Schematic of Linked Infant Death File

ID	Birth Certificate			Death Cert.		
	Maternal Residence	Birth-weight	Maternal Age	Age at Death	...	Cause of Death
BC0102	City	798	17	1	...	P219
BC1904	City	2537	34	22	...	I400
BC3325	City	3511	22	1	...	J129
BC3456	City	2314	25	132	...	R95
BC5123	City	1293	21	128	...	Q232
...
BC5678	City	631	26	3	...	R99



Preparation of Data Data Quality Problems Cause BIAS

- ◆ Missing babies (especially deaths)
- ◆ Missing pieces of information (like birth weight)
- ◆ Incorrect information
- ◆ (see Data Preparation powerpoint)

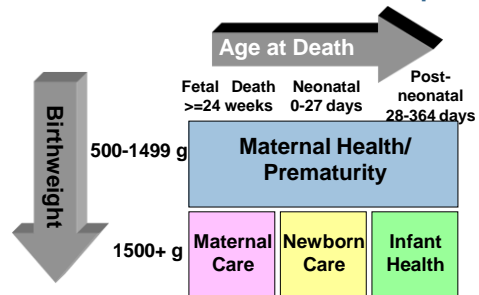


Steps of PPOR Phase 1 Analysis

- ◆ 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



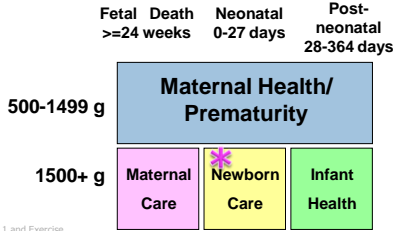
Sort the fetal and infant deaths into the PPOR Map





SORT the Fetal and Infant Deaths

* Example: Infant death, 2499 grams and 22 days old



Place infant deaths in PPOR cells;

```

*sort by birthweight;
if (grams<500) or (grams=9999) then PPORbox="EXCL";
  else if grams<1500 then PPORbox="MPH";
  else do;
*sort higher bw by age at death;
if agedays<28 then PPORbox="NC ";
  else if agedays <365 then PPORbox="IH ";
end;
  
```

Phase 1 and Exercise 14



Place fetal deaths in PPOR cells;

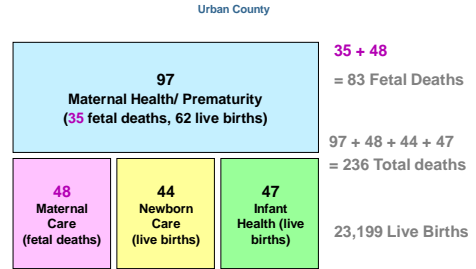
```

*exclude restricted and implausible;
if (grams<500) or (gest_imp<24) or (grams>9999) then
  PPORbox="EX";
*sort by birthweight only;
  else if grams<1500 then PPORbox="MHP"
  else PPORbox="MC";
  
```

Phase 1 and Exercise 15



PPOR Map of Fetal-Infant Deaths



Calculating Fetal-Infant Mortality Rate

Urban County

Formula:
Rate=deaths x 1,000 ÷ denominator

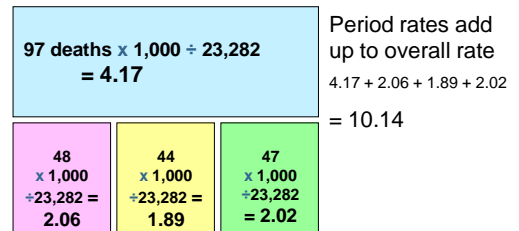
The denominator is the population at risk

$$83 \text{ Fetal Deaths} + 23,199 \text{ Live Births} = 23,282$$



Calculating Fetal-Infant Mortality Rate

Urban County

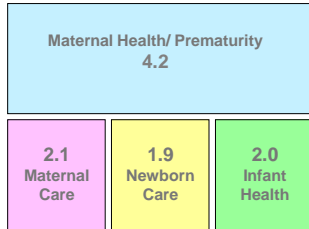


$$\text{Overall rate} = 236 \times 1,000 \div 23,282 = 10.14$$



PPOR Map of Fetal-Infant Mortality Rates

Urban County



Overall Rate
= 10.1
Fetal and
Infant Deaths
per thousand



The Perinatal Periods of Risk Approach

Phase 1 Analysis

Example City Exercise



Example City : Do it yourself!

Where do these fetal deaths get mapped?

Fetal deaths	Under 24 weeks gestation	24 or more weeks gestation
Less than 500g	41	23
500-1499g	33	64
1500g or more	1	81
9999g	23	29



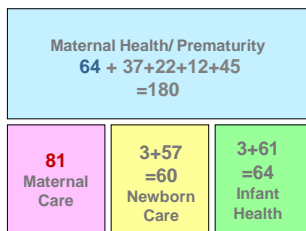
Example City : Do it yourself!

Where do these infant deaths get mapped?

Infant Deaths	0-27 days		28-364 days	
	Under 24 weeks gest.	24 weeks or more gest.	Under 24 weeks gest.	24 weeks or more gest.
Less than 500g	2	3	4	0
500-1499g	37	22	12	45
1500g or more	3	57	3	61
9999g	3	0	1	0



Example City : Do it yourself! Put your counts in the boxes



Total deaths = $180 + 81 + 60 + 64 = 385$



Example City : Do it yourself! The Denominator?

Number of Fetal Deaths (eligible for PPOR)

$$64 + 81 = 145$$

Number of Live Births (eligible for PPOR)

$$36,129$$

Calculating the denominator

$$145 + 36,129 = 36,274$$



Example City : Do it yourself! Calculating Feto-Infant Mortality Rate

$\text{Rate} = \text{deaths} \times 1,000 \div \text{births}$ $= 180 \text{ deaths} \times 1,000 \div 36,274$ $= 4.96$		
$\begin{array}{l} 81 \\ \times 1,000 \\ \hline +36,274 \\ \hline = 2.23 \end{array}$	$\begin{array}{l} 60 \\ \times 1,000 \\ \hline +36,274 \\ \hline = 1.65 \end{array}$	$\begin{array}{l} 64 \\ \times 1,000 \\ \hline +36,274 \\ \hline = 1.76 \end{array}$

Phase 1 and Exercise

25



Example City : Do it yourself!

Calculate the "overall rate" by adding the four box rates

$$\blacklozenge 4.96 + 2.23 + 1.65 + 1.76 = 10.6$$

Calculate the "overall rate" directly, from the total deaths

$$\blacklozenge 385 \times 1,000 / 36,274 = 10.6$$

Now back to Urban County

Phase 1 and Exercise

26



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

Phase 1 and Exercise

27



Urban County Comparing different time periods

Fetal-Infant Rate=10.3			Fetal-Infant Rate=8.8		
4.1			3.5		
2.5	1.8	1.9	1.9	1.4	2.0
1997-2000			2001-2005		

Phase 1 and Exercise



Urban County Comparing Different Subpopulations

White Fetal-Infant Rate = 8.6
(Denom.=16,045)

3.1		
2.0	1.9	1.6

White non-Hispanic

Black Fetal-Infant Rate =17.6
(Denom.=3,291)

8.8		
2.4	2.4	4.0

Black non-Hispanic

Phase 1 and Exercise

29



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.

Phase 1 and Exercise

30



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

Phase 1 and Exercise

31



PPOR Uses a Reference Group



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

Phase 1 and Exercise

32



Reference Group

- ◆ It should have better or optimal pregnancy outcomes.
- ◆ In general, this group should represent roughly 15% or more of the population (NO CHERRY PICKING).
- ◆ It needs to have at least 60 deaths (or 180 for phase 2).



◆ *The community should be involved !*

Phase 1 and Exercise

33



Reference Group

INTERNAL

- ◆ A subgroup from the area under study

EXTERNAL

- ◆ State(s)
- ◆ Counties
- ◆ Similar city
- ◆ National reference group

Phase 1 and Exercise

34



Reference Group Selection

Consider

- ◆ Your study population
- ◆ Data availability
- ◆ Number of deaths
- ◆ Community stakeholder interests

Phase 1 and Exercise

35



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 mothers
- ◆ Black mothers with 13 or more years of education

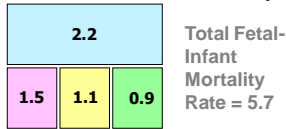
Phase 1 and Exercise

36



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



Phase 1 and Exercise

37



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**

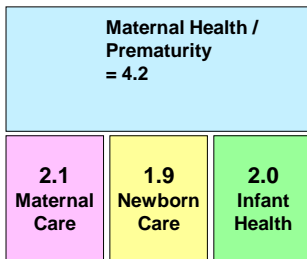
Phase 1 and Exercise

38



Back to Urban County Example, ... What we had done so far ...

Overall Fetal-Infant Mortality Rate = 10.1



Phase 1 and Exercise

39



Calculating Excess Rates

(Urban County vs USA 2000-2002 Reference Group)

	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
Urban County	4.2	2.1	1.9	2.0	10.1
Minus USA Reference Group	2.2	1.5	1.1	0.9	5.7
Equals Excess Mortality Rates	2.0	0.6	0.8	1.1	4.4

Phase 1 and Exercise

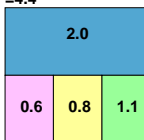
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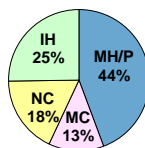
Displaying EXCESS Mortality

(Urban County vs USA 2000-2002 Reference Group)

EXCESS Fetal-Infant Mortality Rate = 4.4



Excess Mortality



Phase 1 and Exercise

41



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

Phase 1 and Exercise

42



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
White	3.1	2.0	1.9	1.6	8.6

Minus USA Reference Group	2.2	1.5	1.1	0.9	5.7
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White Excess Mortality Rates	0.9	0.5	0.8	0.7	2.9
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Phase 1 and Exercise

43



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

Phase 1 and Exercise

44

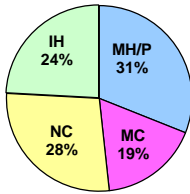


EXCESS Mortality

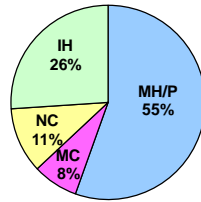
(Urban County vs USA 2000-2002 Reference Group)

White Excess Mortality

Black Excess Mortality



Phase 1 and Exercise



45



CALCULATING EXCESS NUMBER OF DEATHS FROM Fetal-Infant Mortality Rates

(Urban County vs USA 2000-2002 Reference Group)

$$\text{estimated number} = \text{rate} * \text{denominator} \div 1,000$$

Phase 1 and Exercise

46



CALCULATING EXCESS NUMBER OF DEATHS FROM Fetal-Infant Mortality Rates

(Urban County vs USA 2000-2002 Reference Group)

Example using overall rates from right-hand column of previous slide

Racial/ Ethnic Group	Overall Excess Mortality Rate	Live Births and Fetal deaths	Multiply	Number of Excess Deaths
White Non-Hispanic	2.9	16,045	$\frac{2.9 * 16,045}{1,000}$	47
Black Non-Hispanic	11.9	3,291	$\frac{11.9 * 3,291}{1,000}$	39

Phase 1 and Exercise

47



Rates and Numbers Can Tell Different Stories

(Urban County vs USA 2000-2002 Reference Group)

How do we choose?

- ◆ Large excess rates can point to “low hanging fruit” or obvious (though not necessarily easy) solutions
- ◆ Large excess numbers can show overall “burden” or what would “move the needle” city-wide

Phase 1 and Exercise

48



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
All	46	13	18	26	103

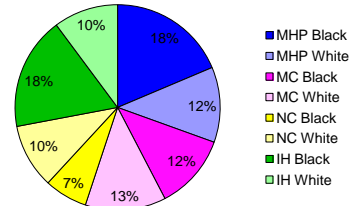
Phase 1 and Exercise

49



Something you can't do with excess mortality rates, but CAN do with excess number of deaths

(Example City, USA 2000-2002 Reference Group)



Phase 1 and Exercise

50



The Perinatal Periods of Risk Approach



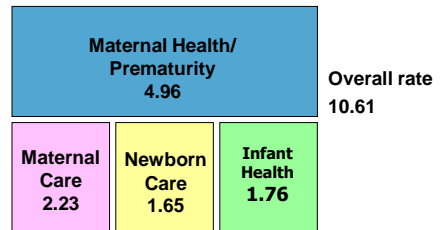
BACK TO Example City Exercise

Phase 1 and Exercise

51



Example City Exercise What we had done so far ... "map" of fetal-infant mortality rates



Phase 1 52

52



Calculating Excess Rates

(Example City, USA 2000-2002 Reference Group)

Urban County	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
All	5.0	2.2	1.7	1.8	10.6
Minus USA Reference Group	2.2	1.5	1.1	0.9	5.7
Excess Mortality Rates	2.8	0.7	0.6	0.9	4.9

Phase 1 53

53

What fraction occurs in the MH/P Period of risk?

$$2.8 \div 4.9 = \boxed{0.57 \text{ or } 57\%}$$

Phase 1 and Exercise

54



CALCULATING EXCESS NUMBER OF DEATHS FROM Fetal-Infant Mortality Rates

(Example City, USA 2000-2002 Reference Group)

Excess Mortality Rate (overall)	Denominator (Live Births and Fetal deaths)	Multiply Excess Rate Times Denominator Divide by 1,000	Estimated Number of Excess Deaths
4.9	36,274	$4.9 \times 36,274 \div 1,000 =$	178

Do the same thing for each period of risk



CALCULATING EXCESS NUMBER OF DEATHS FROM Fetal-Infant Mortality Rates

(Example City, USA 2000-2002 Reference Group)

Period of Risk	Excess Mortality Rate	Multiply by 36,274 divide by 1,000	Excess Deaths
MH/P	2.8	$\times 36,274 \div 1,000 =$	100
MC	0.7	$\times 36,274 \div 1,000 =$	27
NC	0.6	$\times 36,274 \div 1,000 =$	20
IH	0.9	$\times 36,274 \div 1,000 =$	31



Example City

additional information provided for subgroups

Racial Groups	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Overall Fetal-Infant Mortality	Denominator
White, non-Hispanic	68	47	36	31	182	21,393
Black, non-Hispanic	105	32	21	32	190	12,193



Rates are calculated based on the Period numbers by race

(Example City, USA 2000-2002 Reference Group)

White Fetal-Infant Rate = 8.5

(Denom. = 21,393)

3.2		
2.2	1.7	1.4

White non-Hispanic

Black Fetal-Infant Rate = 15.6

(Denom. = 12,193)

8.6		
2.6	1.7	2.6

Black non-Hispanic



Calculating Excess Rates

(Example City, USA 2000-2002 Reference Group)

Urban County	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
White Mortality Rates	3.2	2.2	1.7	1.4	8.5
Minus USA Reference Group	2.2	1.5	1.1	0.9	5.7
Excess Mortality Rates	1.0	0.7	0.6	0.5	2.8



Calculating Excess Rates

(Example City, USA 2000-2002 Reference Group)

Urban County	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
Black Mortality Rates	8.6	2.6	1.7	2.6	15.6
Minus USA Reference Group	2.2	1.5	1.1	0.9	5.7
Excess Mortality Rates	6.4	1.1	0.6	1.7	9.9



Excess Fetal-Infant Mortality Rates

(Example City, USA 2000-2002 Reference Group)

Racial/Ethnic Groups	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
White, non-Hispanic	1.0	0.7	0.6	0.5	2.8
Black, non-Hispanic	6.4	1.1	0.6	1.7	9.9
All	2.8	0.7	0.6	0.9	4.9

Phase 1 and Exercise

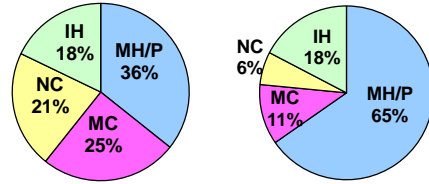
61



EXCESS Mortality

(Example City, USA 2000-2002 Reference Group)

White Excess Mortality Black Excess Mortality



Phase 1 and Exercise

62



CALCULATING EXCESS NUMBER OF DEATHS FROM Fetal-Infant Mortality Rates

(Example City, USA 2000-2002 Reference Group)

Racial/ Ethnic Group	Excess Mortality Rate	Live Births and Fetal deaths	Multiply	Number of Excess Deaths
White Non-Hispanic	2.8	21,393	$\frac{2.8 \times 21,393}{1,000}$	=60
Black Non-Hispanic	9.9	12,193	$\frac{9.9 \times 12,193}{1,000}$	=120
All	4.9	36,274	$\frac{4.9 \times 36,274}{1,000}$	=178

Phase 1 and Exercise

63



Estimated Excess Number of Deaths

(Example City, USA 2000-2002 Reference Group)

Racial/Ethnic Groups	Maternal Health/Prematurity	Maternal Care	Newborn Care	Infant Health	Fetal-Infant Mortality
White, non-Hispanic	21	15	12	12	60
Black, non-Hispanic	78	14	8	21	120
All	100	27	20	31	178

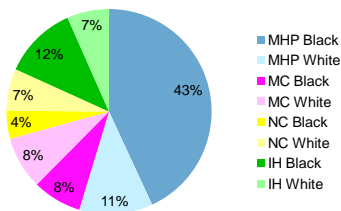
Phase 1 and Exercise

64



Estimated Excess Number of Deaths can be used for all subgroups to show relative burden

(Example City, USA 2000-2002 Reference Group)

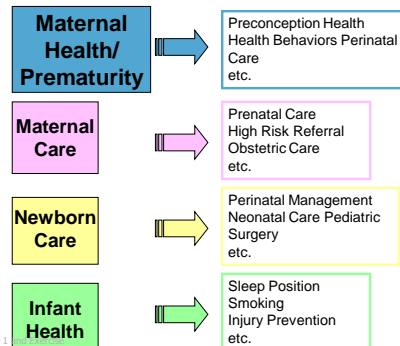


Phase 1 and Exercise

65



Phase 1 Narrows the Choices of Action

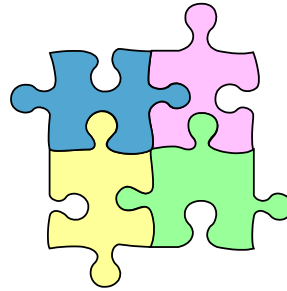


Phase 1

66



Phase 1 is NOT enough.
Phase 2 analyses are REQUIRED to
determine which risk factors are most
important
in YOUR community



BREAK