



Perinatal Periods of Risk: Mapping Feto-Infant Mortality in Kentucky

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Introduction

Infant mortality has long been considered a measure of the health of a society. Sensitive to changes in overall population health, infant mortality is closely monitored and analyzed by most nations in which birth records exist. Declines in this measure have been dramatic over recent years in the United States, due initially to improved population health and standards of care during the prenatal period. More recently, even the smallest infants have been surviving through their first year of life due to a system of neonatal care across the country and advanced technology in most birthing hospitals.

In Kentucky, infant mortality has declined from a rate of 8.43/1000 live births in 1990 to 6.72/1000 live births in 2000. In 2001, the infant mortality rate dropped even further to 5.88/1000 live births. In 2002, however, infant mortality rose precipitously for the first time in decades, to 7.21/1000 live births, an increase of 23% in a single year. This pattern was also reflected on a national level, albeit to a much smaller degree, as the U.S. infant mortality rate rose from 6.84/1000 live births in 2001 to 6.95/1000 live births in 2002. Both Kentucky and national rates declined slightly in 2003, but did not meet 2001 levels.

Since 1997, urban areas throughout the nation have been using the Perinatal Periods of Risk (PPOR) approach, developed by Dr. Brian McCarthy from the Centers for Disease Control and Prevention

(CDC), to monitor and analyze infant mortality. In that year, CityMatCH, a non-profit public health organization of city and county health departments' maternal and health programs affiliated with the University of Nebraska, launched an educational campaign challenging health professionals to examine infant mortality in a new way.

The PPOR model uses birth weight and gestational age to stratify feto-infant mortality data into four separate periods or "cells": Maternal Health/Prematurity, Maternal Care, Newborn Care, and Infant Health. Certain risk factors are specific to each of the four periods (Figure 1, page 4).

The PPOR approach consists of two phases. In Phase I, mortality rates for the target population are compared to those of a reference population. Excess mortality rates are determined, allowing health planners to direct efforts to the areas of greatest need. Phase II involves closer examination of the Maternal Health/Prematurity category via Kitagawa analysis. This method partitions excess mortality rates into portions attributable to birth weight distribution and birth weight-specific mortality, i.e., higher proportions of very low birth weight infants (birth weight distribution) versus higher mortality rates among these same infants (birth weight-specific mortality) as compared to the reference population.

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Very low birth weight (VLBW) infants are considered to be on the “threshold of viability” with complex medical problems that, when not fatal, often result in morbidity and the need for ongoing specialized care. While such births are relatively rare, they contribute disproportionately to mortality (approximately half of all fetal and neonatal deaths are among VLBW infants). Therefore, shifts in birth weight distribution impact mortality rates along with birth weight-specific mortality. Once an infant is born weighing less than 1500 grams, technologically advanced medical care is needed to keep this fragile life viable. Outcomes are thus impacted by the medical care available to the mother and infant throughout the perinatal period (and, in particular, by the regionalization of perinatal care).

Methods

Data were supplied by the National Center for Health Statistics (NCHS) and included linked birth and infant or fetal death files provided to Kentucky for resident births occurring between 1996 and 2001. Records for Kentucky residents who gave birth in Ohio, Tennessee, and West Virginia were also included. Critical to this project was the inclusion of county identifier codes, ordinarily suppressed in public-use data files for counties with fewer than 250,000 residents.

Study regions were created using Rural-Urban Continuum Codes, a classification scheme that distinguishes metropolitan counties by population size and non-metropolitan counties by degree of urbanization, as well as adjacency to one or more metropolitan areas. Counties were classified using year 1993 codes as Urban (codes 0,1,2,3), Semi-Rural (codes 4,5,6), or Rural (codes 7,8,9).

The national reference population consisted of non-Hispanic white women, aged 20 years or older with at least 13 years of education, who gave birth between 1998 and 2000. This group was selected because its pregnancy outcomes were regarded as optimal, while still providing an attainable goal for other populations.

Live births were included if birth weight was at least 500 grams, and fetal deaths were included if gestational age was at least 24 weeks. These cut-points allow for comparisons across states, as state-level vital reporting systems vary in their requirements. PPOR is most effective when the target population has at least 60 fetal and infant deaths during the study period, since mortality rates based on smaller numbers may be misleading.

Results

There were 285,767 live births, 1,075 fetal deaths, and 1,614 infant deaths in the white population and 29,856 live births, 180 fetal deaths, and 249 infant deaths in the black population.

Phase I revealed that the Maternal Health/Prematurity category was the greatest contributor to excess mortality for most race-region combinations. This was particularly true for the black urban, semi-rural and rural populations, which had excess mortality rates of 3.62, 6.59 and 5.65/1000 live births. In this instance, zero excess mortality would correspond to 81 additional black urban, semi-rural and rural infants surviving through their first year of life.

Kentucky’s black urban and semi-rural populations were also challenged in other ways: the urban excess mortality rate was 2.29/1000 live births in the Infant Health category, and the semi-rural excess mortality rates were 2.41 and 1.93/1000 in the Maternal Care and Infant Health categories.

The Infant Health category was identified as problematic for the white rural population, which had an excess mortality rate of 1.31/1000 live births; in this instance, zero excess mortality would correspond to 67 additional white rural infants surviving through their first year of life.

Phase II revealed that between 24.8% and 34.6% of excess mortality in the white population could be attributed to the Maternal Health/Prematurity category, depending on the study region. In the black population, between 42.6% and 65.3% of excess mortality could be so attributed (Figures 2 and 3, page 4).

For the white urban population, the 24.8% contribution to excess mortality was partitioned into portions of 21.3% and 3.5% attributable to birth weight distribution and birth weight-specific mortality; the decompositions were more balanced for the white semi-rural and rural populations, but still reflected the dominant role of birth weight distribution.

The 42.6% contribution for the black urban population was decomposed into portions of 49.2% and -6.6%. In other words, VLBW black urban infants had lower mortality than VLBW infants from the reference population, which offset the excess mortality associated with birth weight distribution.

For the black semi-rural population, the 58.5% contribution to excess mortality was partitioned into portions of 52.5% and 6.0% attributable to birth weight distribution and birth weight-specific mortality respectively, again reflecting the dominant role of birth weight distribution.

In Kentucky's black rural population, the 65.3% contribution was divided into portions of 50.5% and 14.8%, with the latter (birth weight-specific mortality) being considerably higher than in other black populations. However, caution must be exercised in interpreting these results since there were fewer than 60 deaths in the black rural population.

Discussion

Birth weight distribution was the dominant factor in excess mortality for all race-region combinations in the Maternal Health/Prematurity category.

The relative contribution of birth weight distribution in the Maternal Health/Prematurity category to total excess mortality was more than twice as high in the black population as in the white population. The relative contribution of birth weight-specific mortality in the Maternal Health/Prematurity category varied widely. In particular, VLBW black urban infants experienced a survival advantage. This apparent paradox has also been documented in some other perinatal populations. While no such advantage was experienced by VLBW black semi-rural infants, the relative contribution of birth weight-specific mortality in this category was still quite modest. This was not the case for black rural infants, where the contribution was considerably

greater.

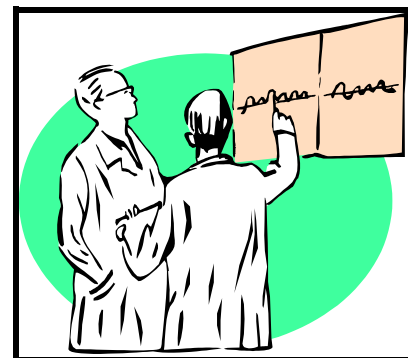
These results raise questions about Kentucky's system of perinatal care. Could provider shortages be affecting Kentucky's perinatal "safety-net" systems, especially in the semi-rural regions? Is medical management available for women with high-risk pregnancies prior to delivery? Are transfer arrangements made, when appropriate, allowing these women to deliver in a tertiary center? Or are high-risk women reluctant to deliver at a tertiary center, preferring instead to remain close to their residence and family?

Conclusion

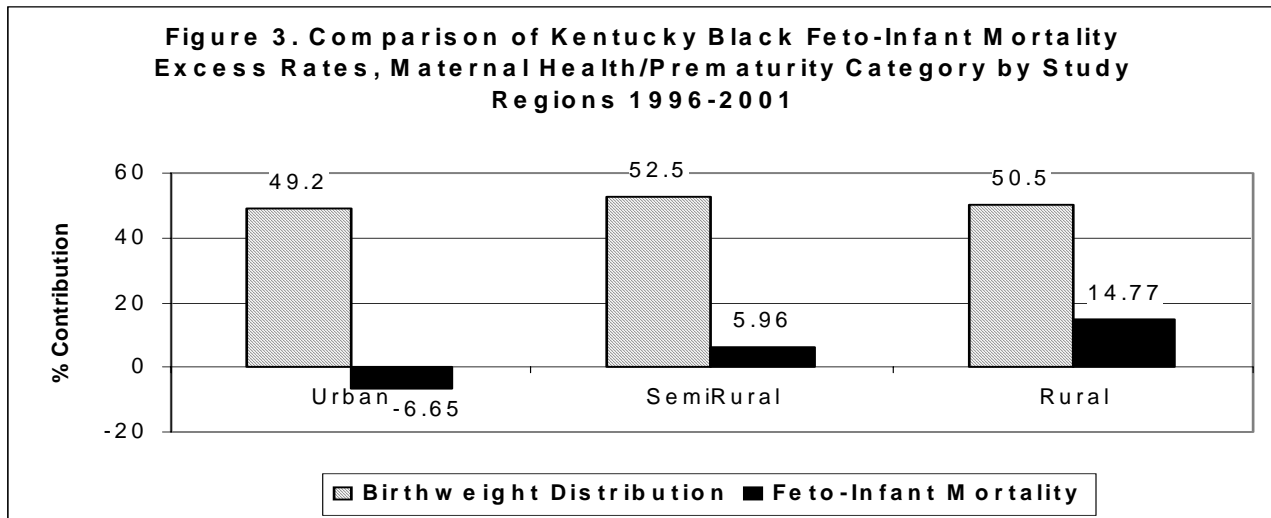
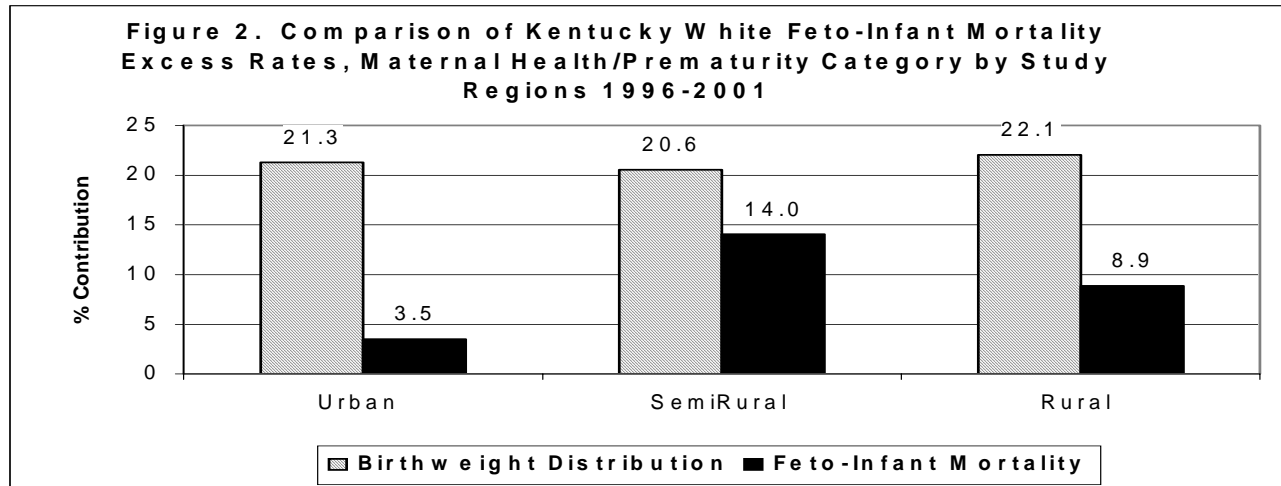
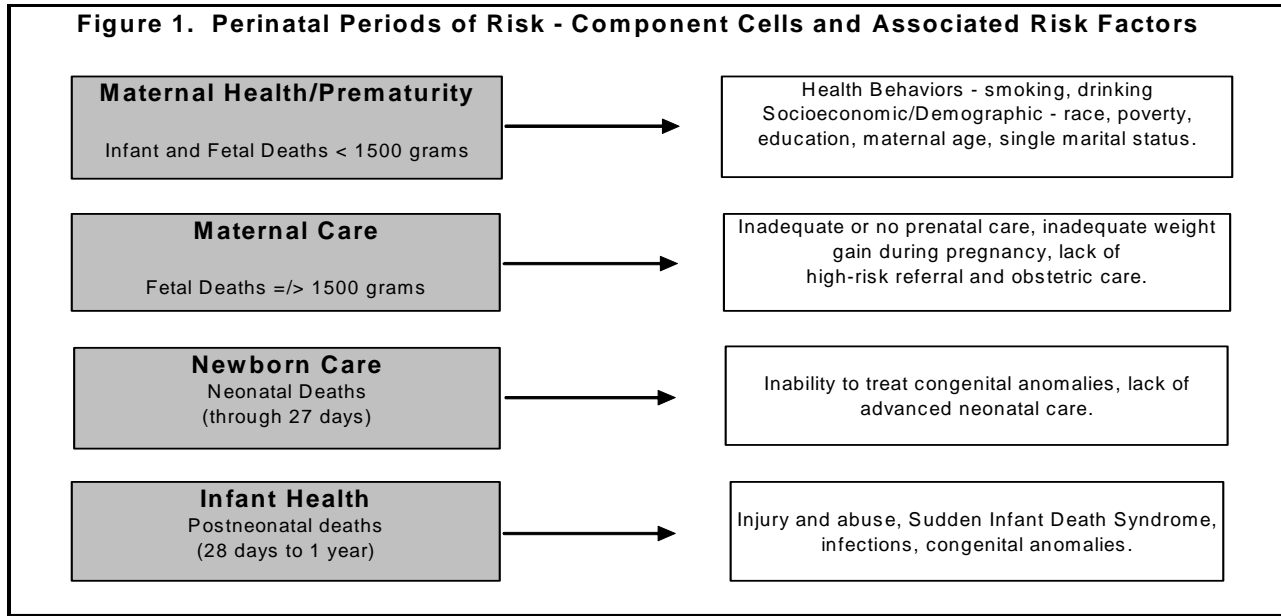
Examining infant mortality utilizing the PPOR approach provides insights about differences in outcomes based on race and region, prompting questions about the reasons for these differences and what can be done to improve outcomes. New analytical methods enable epidemiologists to study the intricacies of infant mortality, allow them to target interventions effectively, and help them to focus limited resources on priority needs.

Editor's Note: Lorie Chesnut recently left her position as Oral Health Epidemiologist to begin doctoral studies at the University of Alabama-Birmingham, specializing in Maternal and Child Health Epidemiology. Ms. Chesnut has been involved with Maternal and Child Health in Kentucky for 15 years and has been a regular article contributor for Epi Notes. Ms. Chesnut will be sadly missed.

Questions or comments concerning this article are welcomed and may be submitted to cheslor@mis.net.



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Polymerase Chain Reaction:**A Faster Way to Serve Kentuckians**

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A new era of molecular methodology has begun in the Division of Laboratory Services (DLS) with the application of polymerase chain reaction (PCR) technology. PCR is a screening tool that allows laboratory professionals to quickly identify disease-causing microorganisms and potential agents of bioterrorism. This technology works by using a genetic probe specific to a unique region of DNA to amplify sequences of DNA. By increasing the amount of DNA present, adequate testing can be performed on several high probability and disease-causing bacteria and viruses. Within DLS, this technology is currently being used in testing for influenza, pertussis, foodborne organisms, and biological agents associated with bioterrorism.

The Virology Section of the DLS will perform PCR on all influenza type A positive cultures to identify the specific strain of the influenza type A. The PCR will not be used as an initial screening method for influenza testing at the DLS because of its expense and due to the high volume of testing that occurs during the influenza season. This information on the strain type is important because it provides the basis for vaccine production and for surveillance of pandemic and novel emerging pathogenic strains.

Pertussis, or whooping cough, is an acute disease of the respiratory tract that is caused by the bacterium *Bordetella pertussis*. Before the vaccine became available in the 1940s, pertussis was one of the most common childhood diseases. It is still a problem among children of developing countries and occurs in Kentucky among the unvaccinated population. Rapid or "Real Time" PCR is conducted by the DLS to confirm the presence of *B. pertussis* and *B. paraptussis* in conjunction with the patient's symptoms. PCR technology is advantageous because *Bordetella* is difficult to culture (1).

In the food microbiology section of the DLS, PCR aids the confirmation of foodborne pathogens in

conjunction with a positive culture. The technology allows for rapid turnaround testing for the presumptive identification of *Listeria*, *Salmonella* species, *E. coli* O157:H7, and *Campylobacter jejuni/coli*.

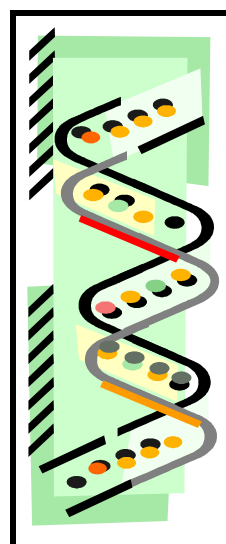
Within the DLS bioterrorism laboratory, PCR testing provides a quick screen for the presumptive identification of biological agents and can confirm several different types of agents in conjunction with other tests.

Overall, the advent of PCR technology provides rapid turnaround for a preliminary identification as opposed to more time consuming and laborious traditional testing methods. Previous methods of biochemical reactions and cultures may require days or weeks to produce results. PCR results are compared with a culture and/or patient's symptoms before a confirmation is made.

For more information, please contact the Division of Laboratory Services at (502) 564-4446.

References

1. CDC. Preventing Tetanus, Diphtheria, and Pertussis Among Adolescents: Use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2006;55(No. RR-3):3-5.



Mumps Immunity for Healthcare Workers Kentucky Department for Public Health

The largest mumps epidemic in America in approximately 25 years has occurred in Iowa and has spread to at least 11 other states, including three that border Kentucky. Mumps may soon spread to Kentucky; however, Kentucky is currently in a mumps pre-outbreak status.

Public Health Healthcare Workers (HCWs) — pre-outbreak

Definition of HCWs: The Centers for Disease Control and Prevention (CDC) defined HCWs as “physicians, nurses, emergency medical personnel, dental professionals and students, medical and nursing students, laboratory technicians, hospital volunteers, and administrative staff” AND as “medical or nonmedical, paid or volunteer, full time or part time, student or nonstudent, with or without patient-care responsibilities,” <http://www.cdc.gov/mmwr/preview/mmwrhtml/00050577.htm>.

The Kentucky Department for Public Health (DPH) recommends that public health (PH) employers assure that HCWs at State and Local Health Departments (LHDs) have documented immunity to mumps by one of the following four options, listed in preferred order:

1. **Identify HCWs born before 1957:** “Adults born before 1957 can be considered immune” to mumps, <http://www.cdc.gov/mmwr/preview/mmwrhtml/00050577.htm>.
2. **For HCWs born in 1957 and after, acceptable immunity to mumps documented before April 2006 would be:**
 - a. **Documentation of physician diagnosed mumps**, with date of diagnosis.
 - b. **Two documented doses** of MMR or other mumps containing vaccines.
 - c. **Laboratory evidence of mumps immunity** (i.e., positive IgG mumps antibody)
3. **Give MMR vaccine** to HCWs born in 1957 or after who have no medical contraindication for receiving MMR vaccine and cannot document immunity, as above, or have only one documented dose of MMR. Give a second dose of MMR, if needed, 28 days or more after the first dose.
4. **Demonstrated laboratory evidence for immunity to mumps, newly obtained in or after April 2006.** Order new laboratory testing for immunity to mumps for HCWs with a medical contraindication (see MMR package insert) to their receiving MMR vaccine.

Work exclusions for HCWs. A HCW with a confirmed clinical case of mumps would need to be excluded from work until 9 days after onset. Exposed, susceptible HCWs may need to be excluded from work for up to two weeks (from the 12th through the 25th day after mumps exposure).

HCWs in Community Settings — pre-outbreak

Recommendations in Options 1 and 2, above, also pertain to HCWs in community settings (hospitals, nursing homes, and physician or dentist offices).

Employers in community settings may choose to implement Option 3 and Option 4 differently from PH employers, based up their cost benefit of providing MMR vaccine (one or two doses) versus new laboratory screening for IgG mumps antibody.

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Mumps Immunity for Healthcare Workers (continued)

Immunity for HCWs in a mumps outbreak:

If a mumps outbreak occurs in Kentucky (i.e., more than five epi-linked cases), a higher level of evidence for HCW immunity to mumps could be recommended.

- Pre-outbreak, review records of HCWs born before 1957 for other evidence of immunity to mumps, as described in Option 2. Having such data additionally available would enable any changes in recommendations to be quickly implemented.
- Currently in Iowa, birth before 1957 is not evidence for HCW immunity to mumps.

National Immunization Awareness Month - August 2006

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Immunization Program

The National Immunization Program (NIP) recommends that everyone be aware of the vaccines recommended for infants, children, adolescents, adults and seniors. Ensuring that individuals receive these immunizations is critical to protecting our families and those in our community from disease.

National Immunization Awareness Month (NIAM) is an opportune time for local organizations to promote education efforts to ensure everyone in their community is vaccinated against diseases. The 2006 goal for NIAM is to **“Increase awareness about immunizations across the lifespan, from infants to the elderly”**.

The theme for this year's campaign is focused around **“Are You Up to Date? Vaccinate!”** August is the time of year when parents are enrolling their children in school, students are entering or returning to college, and health care workers are preparing for the influenza season. This is an ideal time to remind everyone in the community to catch up on their vaccinations.

Immunization was one of the most significant public health achievements of the 20th century. Several life-threatening or debilitating diseases have been eradicated due to childhood vaccination, including smallpox and wild poliovirus in the U.S., and public health has reduced the number of measles, diphtheria, rubella and pertussis cases. Many in the U.S. continue to die from vaccine-preventable diseases. By encouraging families, friends and others in the community to remain up-to-date on their recommended vaccinations, individuals can be protected from serious life-threatening infections.

Immunizations begin early in life, and due to the fact that our children are vulnerable to disease and infection, most vaccinations are given during the first five to six years of life. Adolescents and adults have recommended immunizations and boosters to protect them throughout their entire life. By maintaining high immunization rates, the transmission of disease-causing bacteria and viruses can be interrupted, thus reducing the risk of those unimmunized being exposed to diseases.

The Kentucky Immunization Program, Division of Epidemiology & Health Planning, located within the Department for Public Health would like to encourage all communities across Kentucky to develop a coalition or committee to plan for and conduct activities to educate their community regarding the importance of maintaining the immunization status of all citizens as well as their children throughout their lifespan. Possible activities that could be held include:

- Immunization clinics for all ages
- Involvement/partnerships with civic organizations
- Health fairs
- Proclamation signed by the mayor
- Letters to local newspapers and magazines
- Flyers promoting National Immunization Awareness Month

For more information on NIAM promotional materials, go to www.cdc.gov/nip/home-partners.htm and search under “Programs & Events”.

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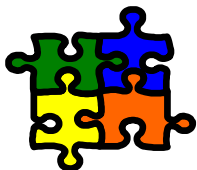
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- Registration fee is payable by **check or money order only**, made payable to the **Kentucky State Treasurer**. Registration fees may be mailed to: Kentucky TB Control Program, ATTN: Melissa Dalton Hopkins, SWC/HP, 275 East Main St., HS2E-B, Frankfort, KY 40621.
- **NO on-site registration will be accepted.** A receipt for registration will be necessary for entrance into the seminar.

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- Participants **must** use the following ID number: **320316** to obtain special room rate.

QUESTIONS?

- Contact Melissa Dalton Hopkins, Social Work Consultant/Health Planner, Kentucky TB Control Program, (502) 564-4276 ext. 3690 or email melissad.hopkins@ky.gov.