Vital Records:

A SOURCE FOR NEIGHBORHOOD INDICATORS

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Vital records are the most universally available and uniform set of administrative records that have been used for neighborhood indicators. Virtually all births and deaths are registered locally and compiled by state governments. The information on birth and death certificates is used to compile measures of the health of the population and to calculate proxies for social conditions and population demographics. Health statistics from vital records, published for the nation and for most states, have played a long-standing role in public health. More recently, some locales are compiling vital statistics for neighborhoods and using the resulting indicators for neighborhood planning and action.

This paper will focus on the use of vital records for calculating neighborhood indicators. Selected indicators will be described in detail along with a discussion of methodological issues and problems in interpretation.

OBTAINING VITAL RECORDS FOR NEIGHBORHOOD ANALYSIS

Birth and death certificates are filed by authorized parties (i.e., hospitals, physicians, coroners, and funeral directors) with the local registrar in the area where the event occurs. However, for neighborhood indicators to work it is necessary to classify the event according to the residence of the newborn or decedent at the time of the event. Local registrars do not have certificates for residents of their jurisdiction who are born or die elsewhere. However, a state agency, typically the health department, registers birth and death certificates for all residents of the state, regardless of where they are born or die. Thus, the state registrar is the most reliable and complete source of certificates for neighborhood indicators work.

One limitation of the state agency as a data source is the time it takes for all certificates to be compiled. Although states produce preliminary tapes periodically, the final tape is not ready until it reasonably can be assumed that all certificates, including those for state residents born or deceased in other states, are received. This process can take over a year, making timeliness of indicators from this data source an issue.

States collect birth certificates, death certificates, and fetal death certificates and store them in a database. Only birth and death certificates will be discussed in this chapter. Fetal deaths are thought to be more incomplete and have not been used in neighborhood indicators work.

Birth certificates generally have two portions, one public and one confidential. The public portion contains the date of birth, identity of the child and parents, and the home address. The confidential portion contains information on the health of the mother and child, the prenatal care, and selected demographic characteristics. The confidential portion of the birth certificate is typically completed by hospital personnel in consultation with the mother. The confidential portion may be obtained for valid research purposes in most states if the privacy of the data can be guaranteed.

Death certificates contain the date of death, identity of the decedent, age at death, home address, place of death, and cause of death. The cause of death is determined by the physician signing the death certificate.

PROCESSING CERTIFICATES FOR NEIGHBORHOOD INDICATORS

All birth or death certificates for a given year usually can be obtained from the state on tape or some other electronic medium for neighborhood indicators work. The records must then be geo-coded so that they can be assigned to neighborhoods. Geo-coding software assigns a geographic designation such as latitude and longitude, census tract, or census block to each record. The records can then be aggregated to local neighborhood designations.

Neighborhood indicators usually are calculated for neighborhoods within a county or municipality rather than for the whole state. Thus, the first step in geo-coding may be to select only those records with the relevant county or city code. Then the mother's home address at the time of birth is selected for geo-coding. In urban areas, approximately 95 percent of these records should be geo-coded successfully if the computerized address files used for geo-coding are up to date. A few records may have post office boxes or errors that make them impossible to assign geographically. These records should be examined to see whether there are any patterns, such as occurring outside the county or in a particular zip code. Records that cannot be geo-coded are assigned to a "missing" geographic designation. While these records are not counted in any neighborhood, they should be included in city or county totals so that these counts can be checked against other published sources.

It is also important to be aware of the problems of missing data and erroneous information on the certificates. Birth and death certificates are typically complete, but in calculating indicators it will be necessary to adjust for missing data. Inaccurate information will be discussed below in conjunction with selected indicators because certain data elements are more error-prone than others.

SMALL AREA LIMITATIONS

Neighborhoods present some problems for calculating social and health indicators because they are much smaller in population than the states or nation, the usual population base for vital statistics. Two important issues for neighborhood indicators are the rarity of certain events and the availability of current population counts for small areas.

Rare Events

There may be too few events of a certain type in a given year to calculate a meaningful rate in small neighborhood populations. A single death in a small area can produce a marked change in an infant

mortality rate, for example. This may not pose a problem for program planning or neighborhood action where the numbers of cases are used to get a sense of service need or magnitude of a problem. However, if the indicator is used as a proxy for health outcomes, a sudden and steep rise in the rate due to a case or two may not really reflect a change in the health status of the population but simply the location of a rare event.[1]

This problem of small areas can be overcome either by aggregating years or neighborhoods or by avoiding the use of rare events. Three-year averages are often used rather than one-year rates when looking at neighborhood trends. Also, contiguous neighborhoods that are fairly similar may be combined when necessary to stabilize rates. Finally, combining or collapsing categories of events can reduce their rarity. For example, deaths from intentional and unintentional injuries might be combined rather than singling out violent deaths for a particular rate.

When producing neighborhood indicators, it is also important to avoid dividing the population into categories that might be small in some neighborhoods. For example, neighborhoods often have a predominant racial or ethnic group, making indicators calculated for the minority races or ethnic groups in the tract unreliable. At the extreme, such rates may violate confidentiality of individuals in small racial or ethnic categories and should not be published. According to census bureau suppression practices, to protect confidentiality, indicators based on vital records should not be calculated for population groups with fewer than 30 members in the neighborhood. Much larger populations are needed to achieve reasonable stability in rates.

Population at Risk

Obtaining a valid estimate of the population at risk for vital events can be quite problematic at the neighborhood level. Vital records can provide counts of various events for each neighborhood, but indicators are typically expressed as rates in which the number of events is divided by the size of the population at risk. The census provides population counts by age, gender, race, and ethnicity for small geographic areas, but these are made only every ten years. Neighborhood indicators, to be useful, need to be calculated more frequently than the census.

The census bureau, state demographers, local planning agencies, and commercial vendors put out population estimates between censuses. The census bureau publishes estimates for counties and cities but not smaller geographic areas. Further, census estimates may not be age, gender, race, or ethnicity specific—the denominators that may be needed for neighborhood indicators based on vital records. In general, the validity of population estimates varies inversely with the size of the population to be estimated. Neighborhood population estimates, especially if broken down by age or other demographic characteristics, have a large margin of error. Nevertheless, many neighborhood indicators in non-census years require population estimates for the denominator. Localities have to choose a provider of estimates or an estimation method that is as valid as possible (Heeringa, 1982; Smith & Cody, 1994).

An additional problem arises when calculating race- or ethnic-specific vital indicators (Hahn, Mulinare & Teutsch, 1992). There may be a discrepancy between the race and ethnic classifications on the birth or death certificates and the census classifications. To begin with, the census asks householders to self-identify the racial and ethnic classification of the members of their household. The racial or ethnic designation on birth and death certificates may be completed by medical personnel. Further, conventions for classifying newborns by race are problematic and have changed over the years. Infants are now classified according to the race of their mother, regardless of the father*s race, but before 1989 both the mother*s and father*s races were taken into account (LaVist, 1994). With respect to ethnicity, there are additional complications because, on the census, Hispanics often classify their race as “other,” whereas on birth certificates they may be assigned to the black or white racial categories. While the census bureau issues data sets that assign Hispanics to a race, the correction is based on estimation methods that are not necessarily consistent with race assignments on birth certificates within neighborhoods. These differences between classification methods on vital records and the census add further validity problems to neighborhood indicators that specify race or ethnic group.

CALCULATING NEIGHBORHOOD INDICATORS FROM VITAL RECORDS

Birth and death records can be used to calculate indicators that reflect the health and safety of neighborhood residents and their access to health services. Indicators calculated from birth and death records can also be used to track sociodemographic changes in neighborhoods. The indicators selected for discussion in this article are summarized in Table 1.

Birth Rates

The crude birth rate is simply the number of births in a neighborhood in a year divided by the total population in that neighborhood in midyear. This indicator is easy to calculate because it uses total population in the denominator rather than a specific population at risk. It can be misleading, though, because neighborhoods differ in their age and gender distribution. Thus, the fertility rate is a preferable measure of births. The fertility rate uses the number of females of childbearing age in the denominator. Childbearing age has traditionally been defined as ages 15 to 44, but the boundaries of this definition are being pushed at both ends of the age spectrum. Another age range for the denominator could be chosen, but this would make the neighborhood statistics less comparable to other published reports. Birth rates are usually expressed per 1,000 population.

Adolescent Childbearing

A particular subgroup whose fertility is often of interest in neighborhood indicators work is adolescents. The teen birth rate is calculated by dividing the number of births to teens by the teenage female population of the neighborhood at midyear and multiplying the result by 1,000. Traditionally, the teen birth rate has used the number of teens ages 15 to 19 in both the numerator and denominator (NCHS,

1997). However, for neighborhood planning, it may be important to also examine birth rates for teens 12 to 14 or to add these age groups into the overall calculations. Whether to look at birth rates by specific age categories may also depend on the size of the neighborhood population. If the population size in any age group is too small, the rates will be unreliable.

The teen birth rate should not be confused with another indicator that is often calculated, the percent of births to teens (Annie E. Casey Foundation, 1997). The percentage of births to teens is calculated by counting births to teen mothers (either under 20 or under 19), dividing by the total number of births and multiplying by 100. While the percentage of births to teens has the advantage of being easy to calculate, it presents problems in interpretation. Specifically, the percentage of births to teens can go up or down because of changing fertility in the non-teenage population. For example, if births to teens stay even but the number of births to older women falls, the percentage of births to teens will rise. Since communities often use this indicator to understand the degree to which teen childbearing is a problem, this ambiguity can be misleading. The teen birth rate is a better indicator of the incidence of teen childbearing in neighborhoods.

Progress in family planning can be reflected in an indicator of repeat teen births. Since birth certificates indicate birth order, it is possible to determine the number of teen births that are second births. This can be converted to a rate by dividing by the population of teen females in the neighborhood and multiplying by 1,000. However, since second births are more rare, this rate will be less reliable than the teen birth rate.

Family Demographics

Determining the proportion of births among various groups within a neighborhood can be used for service planning or as a proxy for demographic shifts that are occurring in the neighborhood. Several calculations are possible. In all instances, the number of births falling into the category of interest is divided by the total number of births in the year. However, only births for which the category is known should be counted in the denominator.[2] In other words, if the birth certificate has incomplete information about the characteristic of interest, that certificate should not be used in the calculation.

The percent of births to unmarried mothers is calculated by counting the number of births to mothers who are unmarried and dividing by the total number of births. A few states do not record the mother's marital status at the time of birth, making it difficult to reliably calculate this indicator in those places. Although the National Center for Health Statistics has methods for imputing marital status in those states (NCHS, 1997), errors could be serious at the neighborhood level. Percentage of births to unmarried mothers can be used as an indicator of sociodemographic change and an indicator of need. It is highly correlated with the percentage of single-parent households in a neighborhood and can be an indicator of changing household composition. This indicator also can point to neighborhoods where there is a need for services for single mothers and their children.

Percent of births by race/ethnicity is sometimes used as an indicator of change in neighborhood demographic composition. It can suggest changes in the needs of young families and help in the planning of programs that are culturally sensitive. The number of births can be counted by racial category although, as noted earlier in this article, classification reflects only the mother*s race. In most states, Hispanic births can be of any race and can be counted separately from counts by race. National origin also is available in some states for some ethnic groups or races. Each of these counts is divided by the total number of births (for which race/ethnicity is recorded) to obtain the percentage of births by category.

Prenatal Care Utilization

Prenatal care is vital to the health of mothers and children and is also a measure of access to primary health care in general. Use of prenatal care can be affected by factors within the health care system and by characteristics of the population. Cost, location, and quality of care are important features of the health care system that will determine use. Availability of information, cultural beliefs and practices and supports for getting to the care facility will affect women*s ability to use the care that is available. A measure of prenatal care utilization cannot distinguish among these factors but reflects the result of all of them in varying combinations.

Percent of births with no prenatal care is calculated by counting the number of births with no prenatal visits and dividing by the total number of births for which the number of prenatal visits is known. In recent years, this figure has been very small but tends to be higher in extreme poverty neighborhoods. Its rarity poses some problems for reliable calculation, but it does represent the most extreme level of risk.

Another commonly used indicator is the percent of births with prenatal care beginning in the first trimester. This is calculated by counting the number of births to mothers whose entry to care was in the first trimester divided by the total number of births for which the mother's trimester of entry is recorded. This proportion has been rising (NCHS, 1997) but tends to be lower in low-income neighborhoods.

Neither of these indicators, though, captures the whole prenatal care period. A more complete indicator is the percent of births with adequate prenatal care. Two alternative methods have been proposed for determining adequacy of prenatal care using birth certificate data (Lantz & Partin, 1997; Perloff and Jaffee, 1997). The most widely used method is known as the Kessner Index (KI) (Kessner, Singer, Kalk & Schlesinger, 1973). To be adequate according to the KI, care must have begun in the first trimester and the total number of visits must equal or exceed that which would be expected for the infant's gestational age at birth.[3]

Kotelchuck (1994) proposed the Adequacy of Prenatal Care Utilization Index (APNCUI) as an alternative to the KI. The APNCUI is determined by combining the results of two component indices, one of which considers the timing of care and the other the number of visits made.[4] Timing of care is considered adequate plus if it began in the first or second month and adequate if it began in the third or fourth month. The number of visits is considered adequate plus if the mother had at least 110 percent of the visits

recommended by the American College of Obstetricians and Gynecologists based on her timing of entry into care and the gestational age of the infant at birth. The number of visits is adequate if it equals 80 to 109 percent of this visit number. Births that are at least adequate on both component indices are counted as having adequate prenatal care.

The KI and the APNCUI have been compared in several studies. With respect to the "percent of births receiving adequate prenatal care" indicator, a New York City study found some discrepancies between the two approaches. Specifically, the KI classified 41 percent of the births as receiving adequate care, whereas the APNCUI classified 29.6 percent as adequate and 17.5 percent as adequate plus for a total of 47 percent that were at least adequate (Perloff & Jaffee, 1997). Such discrepancies could be magnified in smaller areas such as neighborhoods. In addition, both indices must be interpreted with caution because of the ambiguities in the relationship between prenatal care and health outcomes (Lantz & Partin, 1997).

Infant and Newborn Health

The health of newborns is often a marker for overall health status and a proxy for the effectiveness of the health care system. Socioeconomic factors also can have a profound effect on the health of this population. A commonly used indicator of infant health status is percent of low birth-weight births. This is calculated by counting the number of births with weights less than or equal to 2,500 grams (about 5.5 pounds) and dividing by the total number of births for which birth weight is recorded and multiplying by 100. Sometimes very low birth-weight births (less than 1,500 grams) are counted separately, but because they are rarer, these rates can be unreliable for neighborhoods. Low birth-weight rates have been found to differ markedly by neighborhood and to be related to a number of social and economic conditions within neighborhoods (Coulton & Pandey, 1992; Collins & Shay, 1994; O*Campo, Xue, Wang & O*Brien, 1997).

Although not yet widely used, an indicator that incorporates several aspects of infant health is the percent of healthy births based on the healthy birth index (U.S. Department of Health and Human Services, 1997, p. 120). A healthy birth is one that has the following characteristics as part of the birth certificate files: a 5-minute Apgar score of at least 9 out of a possible 10, birth weight of at least 2,500 grams, a gestational age of at least 37 weeks, and maternal receipt of prenatal care within the first trimester. This rate is calculated by counting the number of births that are healthy and dividing by the total number of births for which these data elements are available. This rate reflects more aspects of the infant*s status than weight but may also be more vulnerable to data errors because of problems in the reliability of gestational age and Apgar scores (Lantz & Partin, 1997).

The infant mortality rate is also an indicator of maternal and infant health. Most infant deaths in the United States are connected to problems of pregnancy and prematurity. The infant mortality rate is the number of deaths of infants under 1 year old divided by the number of births in the year multiplied by 1,000. Thus, infant deaths are expressed per 1,000 live births. This calculation requires both birth and death certificates. Although not advisable for neighborhood indicators due to small numbers, the infant mortality

rate can be separated into neonatal deaths (less than 28 days) and postneonatal (between 28 days and 1 year).

Mortality

Mortality indicators draw on death certificate information. Death rates are typically expressed as a function of age. Age-specific death rates can be calculated for selected age groups such as children, adolescents, or other age intervals by counting the number of deaths in that age group and dividing by the population in that age group. Death rates are typically expressed per 100,000 population. Caution must be exercised in calculating age-specific death rates at the neighborhood level because of the small numbers of deaths in many age groups.

Death certificates can also be used to calculate excess mortality, which is an indicator of the relative disadvantage of the neighborhood*s population in terms of health (Geronimus, Bound, Waidmann, Hillemeier & Burns, 1996; McCord & Freeman, 1990). The calculation of excess mortality is complex but provides an estimate of the death rate in the neighborhood that is in excess of that which would be expected for a standardized population. Excess mortality is used to measure the differences in mortality experiences between a standard population and a group of interest such as neighborhood residents (reference population). Excess mortality is considered to be a better indicator of the size of disparity in health than are differences in mortality rates because the indicator takes into account the mortality rates within the population at risk (Manton, Patrick & Johnson, 1987). The choice of the standard population tends to be somewhat arbitrary. However, for comparability among studies, it is advantageous to use the same standard population for the whole county. Typically, the standardized population chosen is the white population of the United States on the assumption that this population represents life expectancy in the absence of social disadvantage.

The standardized mortality ratio (SMR) is used to calculate excess mortality. SMR values greater than one indicate that more deaths are observed in the reference population (population of interest) than would be expected based on the death rates of the standard population (Mausner & Bahn, 1974). The ratio is calculated by dividing the number of deaths that occurred in a year by the number that would have been expected for each age and gender group in the neighborhood. The number of deaths that are expected is based on the size of the population in the age-gender group of the reference population times the death rate for that group in the standard population.

Community Danger

Death certificates can be used to develop indicators of the degree of danger in a community by selecting certain causes of death. Causes of death are coded according to the International Classification of Diseases (ICD-9), which is now in its ninth edition. The homicide death rate, suicide death rate, and accidental death rate can each be calculated by counting the number of deaths due to each of these causes and dividing by the total population times 100,000. Deaths from any of these causes may occur in

small numbers in neighborhoods, making rates unreliable. These causes may be combined to increase stability.

INTERPRETING AND APPLYING INDICATORS

Indicators calculated from vital records, like most neighborhood indicators, do not speak for themselves. They are simply counts and ratios that are believed to be signs of something that is valued: good health, access to services, quality of care, family stability, child well-being, ethnic diversity. The relationship between the indicator and the value, however, is usually indirect and often unspecified. Thus, there is legitimate debate about which indicators to examine and how important they are. Further, most indicators have multiple determinants that are not completely understood. Thus, there are also many reasonable pathways toward changing or maintaining the outcome or condition that the indicator reflects. Finally, indicators are proxies for valued outcomes or conditions rather than direct measures. Thus, thoughtful observers will disagree about what they mean and how high or low they should be.

Calculating neighborhood indicators, albeit a significant effort, is only the beginning step toward understanding neighborhood conditions because of the limitations and ambiguities. Indicators cannot be interpreted in a vacuum, but only within a local context, and their use requires community involvement. But the community is not monolithic, and various stakeholders will bring their own perspectives to interpretation. Community activists may use an indicator to galvanize public opinion or to increase civic involvement. Citizen councils may use indicators to hold local institutions accountable for their performance. Governments may use them to plan programs and evaluate their own performance. Neighborhood residents may use them to promote mutual help and volunteer action. Investors may use them to suggest community viability. The same number at the same time and place may be interpreted differently for any of these uses.

The variation among community perspectives might seem to preclude the possibility of having any systematic ways of interpreting neighborhood indicators. However, several approaches are commonly used and have had some degree of success. First, especially within public health, there is the tradition of establishing goals and comparing indicators with those goals. For example, Healthy People 2000 has specified desired values on several of the indicators discussed in this article. These are national goals, but the concept can be applied to neighborhoods as well. The goal becomes the target value on the indicator toward which communities can work.

A second approach to interpreting indicators is known as benchmarking. This approach compares a community*s achievement on indicators with other communities, often ones that are thought to be in its peer group or at the level to which the community would like to aspire. This approach requires having identical or comparable indicators for similar points in time for relevant comparison communities. Benchmarking has been used by citizen councils to compare their cities with others and to promote public opinion and citizen education for change.

A third approach involves spatial and trend analysis. Although there may not be consensus about the target for an indicator, there is typically agreement about the direction of change that is desirable. Frequently, it is also agreed that the benefits of improvement should be spread fairly evenly, not concentrated in particular areas. Examining trends over time between and among neighborhoods can be useful for determining whether outcomes are moving in the desired direction. Such analyses can also drive the allocation of resources toward selected indicators or neighborhoods in greatest need. United Ways and planning councils have effectively used indicators in this way.

Finally, indicators may play a role in more complex analyses directed toward problem solving or knowledge development. Using indicators in this way requires a conceptualization of how neighborhood outcomes and conditions are related to one another. Such conceptualizations can be used to chart a pathway of change that pushes not just on one indicator but on indicators of the preconditions that are necessary for effective change. Comprehensive community initiatives are beginning to use indicators from many data sources in this way, to create a theory of change for their neighborhoods and to assess their progress along the way.

ENDNOTES

1. It is assumed that the source of vital records provides complete data. Therefore, problems of sampling error for small areas are not discussed here.

2. Certificates may be missing information in a few cases. One way of handling missing data, if it is rare, is to simply calculate the rate based on valid cases. Another option is to replace missing data using an imputation method such as that used by the NCHS (1997). Imputation is statistically complex and has generally not been used for neighborhood indicators. Imputation, which may be sufficiently accurate for large samples, will be less accurate for smaller samples. Neighborhood indicators should not be calculated using data elements for which a large number are missing.

3. To be considered adequate, prenatal care must have begun by the third month and have the number of visits specified for the following gestational ages:

    - gestation less than or equal to 13 weeks requires at least 1 visit
    - gestation 14 to 17 weeks requires at least 2 visits
    - gestation 18 to 21 weeks requires at least 3 visits
    - gestation 22 to 25 weeks requires at least 4 visits
    - gestation 26 to 29 weeks requires at least 5 visits
    - gestation 30 to 31 weeks requires at least 6 visits
    - gestation 32 to 33 weeks requires at least 7 visits
    - gestation 34 to 35 weeks requires at least 8 visits
    - gestation 36 weeks or greater requires at least 9 visits

4. The computer program for calculating these indices can be obtained from Dr. Kotelchuck, Department of Maternal and Child Health, University of North Carolina at Chapel Hill.

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Table 1: Selected neighborhood indicators from vital records

Indicator	Numerator	Denominator
Birth rates		
Crude birth rate (*per 1,000)*	Number of births	Population at midyear
Fertility rate (*per 1,000)*	Number of births	Number of females of childbearing age (15-44) at midyear
Adolescent childbearing		
Teen birth rate (*per 1,000)*	Number of births to teen mothers	Number of teen females at midyear
Percent of births to teens	Number of births to mothers under age 20	Total number of births
Repeat teen births (*per 1,000)*	Number of second births to teen mothers	Number of teen females at midyear
Family demographics		
Percent of births to unmarried mothers	The number of births to mothers who are not married	Total number of births
Percent of births by race/ethnicity	The number of births that are classified in each race/ethnic group	Total number of births
Prenatal care utilization		
Percent of births with no prenatal care	Number of births with no prenatal care	Number of births with valid data on number of pre-natal visits
Percent of births with prenatal care beginning in first trimester	Number of births with prenatal care in first trimester	Number of births with valid data on trimester of prenatal care
Percent of births with adequate prenatal care	The number of births with adequate prenatal care	Number of births for which adequacy of prenatal care index can be calculated.
Infant and newborn health		
Percent of low birth-weight births	Number of births with weights less than or equal to 2,500 grams	Number of births for which birth weight is recorded
Percent of healthy births	Number of births that are healthy	Number of births for which index can be calculated
Infant mortality rate (*per 1,000)*	Number of deaths of infants under age 1	Total number of births

Table 1: Selected neighborhood indicators from vital records (continued)

Indicator	Numerator	Denominator
Mortality		
Age-specific death rates (*per 100,000*)	Number of deaths for age group	Population in age group
Excess mortality ratio	Observed number of deaths by age and gender	Expected number of deaths based on age and gender of population and death rates in standard population
Community danger		
Homicide death rate (*per 100,000)*	Number of deaths classified as homicide	Population at midyear
Suicide death rate (*per 100,000)*	Number of deaths classified as suicide	Population at midyear
Accidental death rate (*per 100,000)*	Number of deaths classified as accidental	Population at mid-year