Relation Of Infant Mortality To The Availability Of Maternity Care In Rural Florida

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Background: **This cross-sectional study was designed to explore the impact of the availability of maternity care services on the infant mortality rates in nonmetropolitan (rural) counties in Florida.**

Methods: **We evaluated the sufficiency of physicians providing maternity care in each rural county. We then constructed a mathematical model to compare physician availability with the infant mortality rates for each county, while controlling for socioeconomic variables.**

Results: **Thirty-one family physicians and 974 obstetrician-gynecologists were delivering babies in Florida in 1991. Forty-seven counties were lacking in maternity care services; 45 of these counties had family physicians who practiced in the county but did not provide maternity care services. There was a negative correlation in rural counties between availability of maternity care services and infant mortality ($R = -0.42$, $R^2 = 0.176$, $P = 0.012$), implying that 17.6 percent of the variation in rural Florida's infant mortality was explained by a ranking in physician availability. Multivariate analysis revealed that increasing infant death rates can be predicted by decreasing physician availability ($P = 0.003$). A multiplicative risk model developed for this study demonstrated that the loss of 1 family physician delivering babies would predict the increase of infant mortality by 2.3 percent, and the loss of 1 obstetrician-gynecologist increased infant mortality by 9.6 percent.**

Conclusions: **Access to maternity care for women in rural Florida is a problem that could be hampering Florida's ability to reduce its infant mortality rate. Family physicians appear to be the most geographically distributed health care providers in Florida; therefore, strategies should be developed to recruit Florida's rural family physicians into maternity care. (J Am Board Fam Pract 1995; 8:392-9.)**

Maternity care has been a basic component of general medical care since the advent of modern medicine[1] and a core element of family practice since the specialty was formed.[2] Nowhere has this fact been more evident than in the nonmetropolitan areas of the United States.[3] During the last decade the number of family physicians actively delivering babies has dropped dramatically[4-8] reportedly because of (1) malpractice liability issues, such as increasing malpractice liability insurance premiums and fear of being sued,[9-19] and (2) professional and personal lifestyle issues.[19-22] Although the validity of these concerns has been questioned,[21-24] they appear to influence the decision making of medical students[25-27] and family practice residents[19,20,28,29] who choose not to provide maternity care in practice.

Not only are most family physicians not providing maternity care, but practicing physicians are increasingly ceasing to deliver babies.[30] As recently as 1980, 46 percent of family physicians delivered babies.[31,32] By 1987 only 28.7 percent of the members of the American Academy of Family Physicians (AAFP) still delivered babies in hospitals,[33,34] decreasing to 24 percent by 1992.[35] This decreasing trend has been noticed in every state studied to date, including Alabama,[36] Arizona,[37] Connecticut,[38] Florida,[17,23] Indiana,[3] Mississippi,[39] Missouri,[40] North Carolina,[41] Ohio,[42] Oklahoma,[43] Oregon,[12] Pennsylvania,[44] Texas,[45] and Washington.[46] The tragedy of the trend in family practice away from maternity care is that it appears to be decreasing access to maternity care in our country.[3,8,10,12,16,22,47-50] Although most evident in the nonmetropolitan areas,[3,8,12,51-55] it is also now seen as an emerging problem in inner-city America[55-57] and among economically disadvantaged women.[56-59]

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Florida is geographically a nonmetropolitan state with about one-half (35 of 67) of its counties being rural[60] (a rural county is a nonstandard metropolitan statistical area [SMSA]; an SMSA county has at least one city with a population of 50,000 or more[3]). Florida's family physicians are located in 65 of the state's 67 counties.[60] In addition, Florida's infant mortality rate of 9.7 deaths per 1000 live births[60] (15.4 among nonwhites[60]) is higher than that of most other states[61] and at least 22 "developed or westernized" countries[61] and is viewed with alarm by policy makers in Florida who see a state health care system where "there are about 2.5 million people . . . who can't afford health insurance, . . . public health clinics are overwhelmed, . . . most obstetricians are unwilling to treat Medicaid recipients, and 21 percent of pregnant women . . . don't receive proper prenatal care."[62]

Allen and Kamradt[3] have suggested that decreased access to maternity care in rural areas of Indiana resulted in an increase in infant mortality. They assumed, and others have shown,[63] that factors other than access can affect infant mortality, such as ethnicity, increasing levels of education, and economic status.[3,63] Our study was designed to replicate theirs by testing the hypothesis that decreased physician availability of maternity services in rural areas is associated with an increase in infant mortality. Further, if the association could be established, we wanted to describe and apply a new multiplicative risk model to the data set.

Methods

A list of generalist physicians and obstetrician-gynecologists delivering babies in each county of Florida in 1991 was assembled through four sources: (1) a 1991 survey sponsored by the Florida Academy of Family Physicians,[64] (2) a 1991 survey sponsored by the Frontier Med-Pro Insurance Company for the Florida Academy of Family Physicians' Obstetrical Task Force,[65] (3) the Florida Obstetrics Manpower Report of 1991,[66] sponsored by the Florida Obstetrics and Gynecological Society and the Florida Section of the American College of Obstetricians and Gynecologists, and (4) a 1992 survey of each of Florida's Department of Health and Rehabilitative Services County Public Health Unit directors, performed for us by the Florida Department of Health and Rehabilitative Services.

State or county populations, number of live births, birth rates, infant mortality rates, ethnicity of births (percentage of nonwhite resident births), and SMSA data were obtained from the Florida Department of Health and Rehabilitative Services for the years 1987 through 1991.[60] Perinatal mortality rates for each of the counties during these same years were not available. Socioeconomic data for each county included median household income and education (percentage of population with 16 or more years of education).[67]

To determine a value for the availability of maternity care services in an individual county, the number of practicing physicians who delivered babies in 1991 in each county (family physicians, general practitioners, and obstetrician-gynecologists) in active patient care (20 or more hours per week) was compared with the number of live births by women living in but not necessarily giving birth to their babies in that county. The average number of deliveries per year was estimated to be 50 per family physician and 200 per obstetrician-gynecologist, based upon the studies of Wigul, et al.[39] and Allen and Kamradt.[3] A potential physician availability value for maternity care services in each county was developed using the method of Allen and Kamradt.[3]

This value for physician availability in rural or nonmetropolitan (non-SMSA) counties was compared with that county's infant mortality rate (total, white, and nonwhite) for the years 1987 through 1991, the most recent data available for analysis at the time of our study. To allow for estimating the effect on infant mortality of an increase or decrease in physician availability for maternity services, we developed a method using linear regression to predict the number of infant deaths in each county while adjusting for the number of live births for residents of each county. By using this method, we could observe what effect an index of availability of physician maternity care services (INDEX), the total number of births, and several socioeconomic factors (such as the percentage of the county's population with 16 or more years of education, median family income, and ethnicity or percentage of nonwhite births) would have on the predicted number of infant deaths.

The INDEX would equal the number of generalist physicians (GPs) delivering babies multiplied by 50, added to the number of obstetrician-

gynecologists (OBs) delivering babies multiplied by 200:

$$\text{INDEX} = (\text{GPs} \times 50) + (\text{OBs} \times 200)$$

We then assumed that the number of infant deaths in each county would be the product of the number of births, some functions of socioeconomic status, and a constant of proportionality. A logarithmic transformation of this product yields a linear relation of multiple regression. To control for possible confounding effects of income, ethnicity, and education as possible explanations of why some counties might have better health care than others, the median household income, the percentage of the nonwhite resident population, and the percentage of the county's population with 16 or more years of formal education were used as covariates in the multivariate analysis. The multiplicative risk model developed for this study resulted in log-transformed variables for birth and death that conformed to normal distributions, so that the *P* values resulting from the regression were believed to be valid. Coefficients for each of the variables in the regression are shown in Table 1. In this model regression coefficients, estimated through least squares, were interpreted to look at the effect on infant mortality of physician availability for maternity care services, while controlling for the number of total births and the socioeconomic variables of ethnicity, median income, and education.

Results

There were in 1991 at least 1005 physicians delivering babies in Florida; 31 family physicians and 974 obstetrician-gynecologists. The availability of physician-provided maternity care services, by county, is shown in Figure 1. Of the 67 state counties, 27 (40 percent) had no delivery facilities at all, and all but one of these counties reported no physicians of any specialty who delivered babies. The average drive from the county center of these counties to the nearest delivery facility was 43.4 miles (range 19 to 80 miles). These 27 counties had populations that ranged from 5569 to 110,975 and a combined population of 582,336, which represented 4.5 percent of the state's population in 1991. Thirty-five (50 percent) of the 67 state counties were rural (non-SMSA) counties and 27 (77 percent of Florida's rural counties) did not have delivery facilities. These rural counties had populations that ranged from 5569 to 152,104 and a combined population of 627,999, which represented 4.9 percent of the state's population in 1991.

Family physicians delivered babies in 9 (13 percent) of the 67 counties, but only 5 (16 percent) of the 31 family physicians who delivered babies did so in rural counties. Of the 17 family physicians who delivered babies and who were in full-time private practice, 3 (18 percent) lived in rural counties and 14 (82 percent) lived in urban counties with a population of more than 100,000. Family physicians practiced in 65 (97 percent) of the 67 state counties and in 33 (94 percent) of the 35 rural counties. Only 1 family physician delivered babies in a county with no obstetrician-gynecologist.

Obstetrician-gynecologists delivered babies in 40 (60 percent) of the counties, but only 43 (4 percent) of the 974 obstetrician-gynecologists who delivered did so in rural counties. In 1991 only 974 (61 percent) of the 1590 obstetrician-gynecologists delivered babies. Obstetrician-gynecologists practiced in 47 (70 percent) of the state's 67 counties and in 13 (37 percent) of the 35 rural counties.

Based on the value measuring physician availability for maternity care services (INDEX), 47 (70 percent) of the 67 counties and 31 (89 percent) of the 35 rural counties had an insufficient quantity of physician-provided maternity care services; that is, there were more deliveries than

Table 1. Coefficients of the Model Including All Covariates Predicting the Log of Infant Death Rate.

Variable	Coefficient	Standard Error	T for HO: Coefficient = 0	*P* Value Two-Way
Intercept	−5.226	0.576	−9.076	0.001
Percent nonwhite	0.244	0.208	1.174	0.2504
Miles driven to deliver	0.004	0.002	1.454	0.1571
Total births	1.145	0.079	14.425	0.0001
Education	0.012	0.019	0.660	0.5149
Income	−0.011	0.018	−0.616	0.5425
INDEX	−0.000452	0.0001	−3.229	0.0032

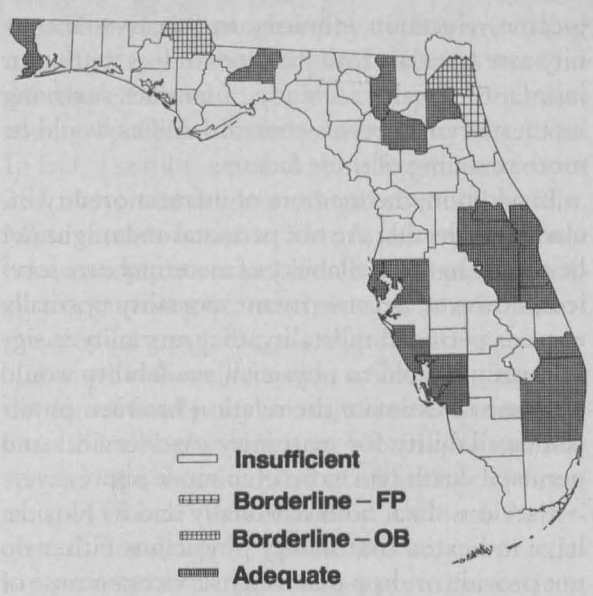

Figure 1. A Florida map indicating level of maternity care services by county. FP = family physicians, OB = obstetrician-gynecologists.

the supply of physicians could serve. Three (5 percent) of the counties had borderline availability of maternity care services, in that the loss of only 1 physician would cause service to become insufficient. Two of these counties were obstetrician-gynecologist borderline and one was family physician borderline. Seventeen (25 percent) of the 67 counties, but only 3 (9 percent) of the 35 rural counties, had adequate availability of physicians to provide maternity care (Figure 1).

The comparison between physician availability and infant mortality is shown in Figure 2. A Spearman correlation coefficient of −0.42 (P = 0.012, 95 percent confidence interval = 0.10–0.74) was obtained for this graph. The R^2 of 17.6 implies that 17.6 percent of the variation in Florida's infant mortality in nonmetropolitan counties was explained by a ranking in physician availability. In the multivariate analysis, the variable of physician availability (INDEX) was significantly associated with the infant death rate (P = 0.003).

Additionally, the variable of physician availability (INDEX) was treated as a control variable, so that by varying the INDEX, the predicted effect of a physician adding or deleting maternity care services to his or her practice could be estimated. The comparison between the log of infant mortality and the expected deliveries per county is shown in Figure 3. Using the assumptions of Allen and Kamradt[3] and Wigul, et al.[39] that a family physician could deliver 50 babies a year and an obstetrician 200 babies a year, and assuming that the family physician increased INDEX by 50 and the obstetrician by 200, then the loss of a single family physician delivering babies in rural Florida would be predicted by this model to be associated with an increase of that county's infant mortality by 2.3 percent, and the loss of a single obstetrician-gynecologist in rural Florida would be predicted to be associated with an increase of infant mortality by 9.6 percent. These data would imply that for a rural county in Florida, which experienced 10 infant deaths per year, the addition of an obstetrician-gynecologist would save, on average, 1 baby's life.

Discussion

These data indicate that there is an association between infant mortality in rural Florida and the availability of physicians providing maternity services; however, cause and effect cannot be surmised from these data. Although a correlation is necessary to prove causality, it is not a sufficient condition for proving a causality; therefore, these data can only be said to show that increasing maternity care services is consistent with reduced infant mortality in the population studied for the

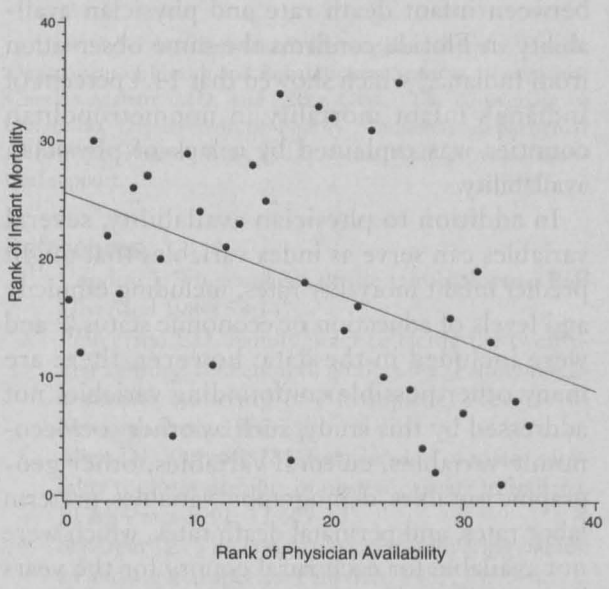

Figure 2. Infant mortality per 1000 births for the years 1987–1991 (inclusive), by county in rural Florida, plotted against the physician availability value for that county. The black line is the regression line for this analysis (R = −0.42). Infant mortality is inversely related to physician availability (P = 0.012).

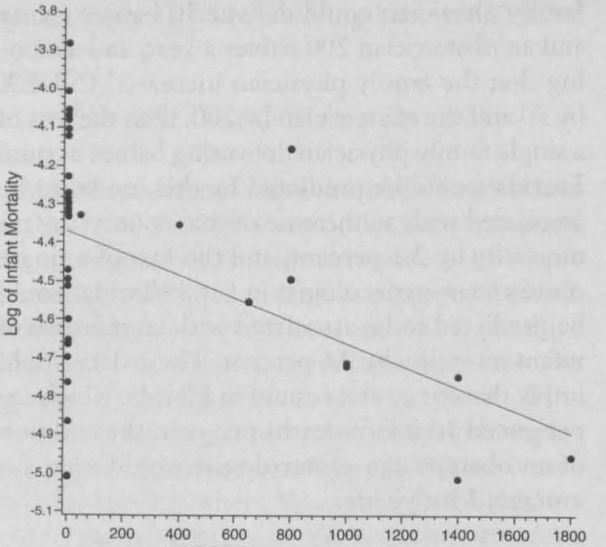

Figure 3. Multiplicative risk model. Log-transformed infant mortality (per 1000 live births for the years 1987–1991, inclusive), by county in rural Florida, plotted against the expected number of deliveries per county that providers would do per year. The black line is the regression line for this analysis.

years included in the study and that comparing the covariates measured shows the INDEX has a stronger effect than income, education, or ethnicity in predicting infant mortality. This association between infant death rate and physician availability in Florida confirms the same observation from Indiana,[3] which showed that 14.4 percent of Indiana's infant mortality in nonmetropolitan counties was explained by a lack of physician availability.

In addition to physician availability, several variables can serve as index variables that might predict infant mortality rates, including ethnicity and levels of education or economic status,[63] and were included in the data; however, there are many other possible confounding variables not addressed by this study, such as other socioeconomic variables, cultural variables, other geographic variables, demographic variables, preterm labor rates, and perinatal death rates, which were not available for each rural county for the years included in this study. It is easily conceivable that many additional factors not measured by these data could or would influence the outcome of the study, possibly even refuting its conclusions.

A further limitation is that this study is by nature an aggregate study and does not show how income, education, ethnicity, and access to maternity care translate into the types of loss that occur in infant mortality. A study of families surviving infant mortality versus control families would be more revealing of these factors.

In addition, the measure of infant mortality includes deaths that are not perinatal and might not be related to the availability of maternity care services; however, because infant mortality normally exceeds perinatal mortality, that mortality is significantly related to physician availability would lead one to estimate the relation between physician availability for maternity care services and perinatal death rate to be even more impressive.

Previous data, both nationally and in Florida, have indicated that family physicians either do not provide or drop maternity services because of malpractice considerations (such as fear of lawsuit or cost of insurance) or personal lifestyle considerations (such as personal or lifestyle disruptions). Our data, along with those of Allen and Kamradt,[3] would suggest a family physician's decision to exclude maternity services from his or her practice, at least in rural Florida and Indiana, might involve more than these personal considerations.

The multiplicative risk model results indicate that the trend for family physicians in Florida to choose not to provide maternity services in these rural or nonmetropolitan counties is associated with an increase in the infant mortality; however, these data should not and cannot be interpreted to imply a cause-and-effect relation.

In addition, these data would indicate that the small number of family physicians providing maternity care services in rural Florida is critical to the health of the childbearing families of the counties they serve, as the loss of a single family physician providing maternity services could be associated with a 2.3 percent increase in infant mortality.

The results of these data would indicate that overall Florida does not have a shortage of maternity care; rather there is a serious maldistribution of maternity care. Physician availability for maternity care is inadequate in 47 (70 percent) of the counties in Florida. In the rural counties, however, the situation is worse with 31 (89 percent) of the counties having inadequate maternity care. Although many reasons would prevent obstetrician-gynecologists from moving to and practicing in rural Florida, these data would sug-

gest that if the surplus physicians providing maternity care in oversupplied counties were redistributed to counties with shortages, then every county would have sufficient availability of services. In fact, a surplus equal to the obstetric services of 287 obstetrician-gynecologists would remain. Most rural counties in Florida, however, do not have an adequate population for a single obstetrician-gynecologist, much less an obstetrician-gynecology group for on-call purposes.

A more reasonable option would be to increase the use of family physicians to provide maternity care. Family physicians in Florida, as in most states,[35] are already distributed in most (94 percent) of Florida's rural counties. Although 96 percent of Florida's family physicians are not practicing prenatal or intrapartum maternity services, most family physicians are trained to provide these services. If even some of the family physicians already practicing in Florida's rural counties would include maternity care services in their practices, then these counties might have sufficient availability of maternity care (or at least prenatal care) services. Further study should be considered to evaluate the availability, willingness, and feasibility of retraining and utilizing this large potential maternity care resource.

In addition to examining currently available provider resources for maternity care services, Florida must closely examine the flow of physicians, particularly family physicians, into and out of its rural counties. Specific programs to encourage family physicians who plan to provide maternity care to enter practice in rural counties and to stay in these practices need to be developed.

Future study in this area could evaluate the relation between the availability of all types of maternity care providers (including public health nurses and lay or certified nurse midwives) and miles traveled for this care and perinatal outcomes, such as low and very low birth rates and perinatal mortality.

The problems of infant mortality involve many factors that are complex, multivariate, and difficult to investigate, and the problem of physician availability is only one of many facing the rural citizens of Florida, in addition to reimbursement issues for rural hospitals and physicians. It does appear, however, that the inadequate number of family physicians providing maternity care in rural Florida is reducing the quality of care received by the childbearing families in the nonmetropolitan counties in Florida. The Institute of Medicine has stated that, "Prenatal care should be plentiful enough in a community to enable all women to secure appointments within two weeks with providers close to their homes."[68] Our findings would indicate that the outlook for reaching this goal in rural Florida is currently limited. The ability of the state and the medical profession to meet this goal in the future will require coordinated and rapid action.

Conclusions

Limited access to maternity care for women in rural Florida (both providers and facilities) and an extremely limited availability of family physicians who provide maternity care services in rural Florida are major problems that could be hampering Florida's ability to reduce its infant mortality. Family physicians are the most evenly distributed health care providers in Florida — practicing in 97 percent of all counties in Florida and in 100 percent of the rural counties that have physicians. Strategies should be developed to recruit or encourage Florida's rural family physicians to provide maternity care and to recruit family physicians, particularly those who desire to provide maternity care services, into these areas.

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