

Local Health Department Perspectives on Linkages Among Birthing Hospitals

Donna M. Strobino, PhD
Gillian Beth Silver, MPH
Adam A. Allston, MPH, MSW
Holly A. Grason, MA

OBJECTIVES:

To describe perinatal linkages among hospitals, changes in their numbers and their impact on relationships among high-risk providers in local communities.

STUDY DESIGN:

Data were obtained about the organization of perinatal services in 1996–1999 from a cross-sectional study evaluating fetal and infant mortality review (FIMR) programs nationwide. Geographic areas were sampled based on region, population density, and the presence of a FIMR. A local health department representative was interviewed in 76% ($N = 193$) of eligible communities; 188 provided data about hospitals.

RESULTS:

Linkages among all hospitals were reported in 143 communities and with a subspecialty hospital in 122. All but 12 communities had a maternity hospital, and changes in the number of hospitals occurred in 49 communities. Decreases in the number of Level II hospitals were related to changes in relationships among providers of high-risk care for mothers and newborns; they were associated with changing relationships only for mothers in Level I hospitals. These relations were noted only where established provider relationships existed.

CONCLUSIONS:

Decreases in the number of maternity hospitals affect provider relationships in communities, but only where there are established linkages among hospitals. *Journal of Perinatology* (2003) **23**, 610–619. doi:10.1038/sj.jp.7210993

INTRODUCTION

Studies conducted in the 1970s show considerable evidence that the development of regionalized systems of perinatal care were successful in reducing mortality rates among high-risk infants. In locations where regionalized systems were implemented, there also was a greater concentration of high-risk newborns, as defined by very low birth weight (VLBW, <1500 g) births, at tertiary hospitals, and the death rates of LBW (low birth weight, <2500 g) infants born in these hospitals were lower than the rates of infants born in community hospitals. In some locations, survival rates also increased among LBW infants born at community hospitals, presumably due to their transfer to tertiary hospitals for intensive care.¹ Moreover, reductions in neonatal mortality rates were found in states and geographic areas, particularly for LBW infants, following implementation of regionalization.² More recent studies continue to show the benefit of neonatal intensive care in tertiary hospitals for VLBW infants,^{3–8} and that there is no survival advantage for VLBW infants born in Level II hospitals relative to those born in community hospitals.³

The report *Toward Improving the Outcome of Pregnancy: The 90s and Beyond* (also referred to as TIOP II) by the Committee on Perinatal Health reaffirmed the importance of strong regional perinatal health-care systems first promoted in *Towards Improving the Outcome of Pregnancy* (TIOP I) in 1976.^{9,10} For the past several years, however, concerns have arisen about the organization of perinatal health care in communities across the country. These concerns stem from reports of increases in the numbers of hospitals providing more specialized perinatal health care and the presumed disruptions they cause in established linkages among hospitals originally developed as part of regional perinatal systems.^{5,7} There remains, nevertheless, a dearth of information on the organization of hospital-based perinatal care in local communities.

The regional systems recommended by TIOP I (1976), TIOP II (1993), and the Guidelines for Perinatal Care (1997) include three levels of in-patient hospital care — basic (Level I), specialty (Level II), and subspecialty (Level III) care — intended to facilitate the delivery of risk-appropriate care to mothers and newborns.^{9–11} These levels of care pertain to the capabilities of facilities with regard to the type of care provided and the patients who receive care. They refer to increasing levels of services and complexity of patient problems as one moves from a community hospital providing basic care to a subspecialty facility where care is

Women's and Children's Health Policy Center, Department of Population and Family Health Sciences, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA.

Development of this manuscript was funded by project # U93 MC 00101 from the Maternal and Child Health Bureau, HRSA, US Department of Health and Human Services (Title V of the Social Security Act). Opinions expressed in this publication are those of the authors and do not necessarily reflect the views or policies of the Bureau, HRSA, or the Department of Health and Human Services.

Address correspondence and reprint requests to Donna M. Strobino, PhD, Department of Population and Family Health Sciences, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe Street, E4153, Baltimore, MD 21205, USA.

available for life-threatening complications in the mother and newborn. Regional networks established relationships among the three levels of care in order to ensure that specialty and subspecialty care were available to all who need such services.^{5,7,12}

Since the dissemination of the TIOP I's initial recommendations for regionalization of perinatal health services, there has been an increase in the availability of neonatal providers and diffusion of improved technology to care for the high-risk mother and newborn. In 1976, there were 125 neonatal intensive-care units (NICUs) in North America. By 1995, there were over 600, including both Level II and Level III nurseries.^{13–15} Between 1968 and 1994, 49 of 96 hospitals in North Carolina increased their level of neonatal services, whereas none reduced the level of care they provided.¹⁶ Increases in the level of neonatal services at hospitals have been reported in other states,^{5–7} although changes have not been assessed for as long a time period as in North Carolina.

The development of NICUs undoubtedly has been fueled by an abundance of recently trained neonatologists.¹⁷ Many health-care professionals also are concerned that market forces, such as increased competition among hospitals for perinatal patients and penetration of managed care,¹⁸ may have disrupted the organization of perinatal health services, particularly with regard to historical relationships among providers and facilities.^{14,19,20} Few studies, however, indicate that a reversal of or disruption in the organization of perinatal services has occurred.^{5,7,16,21} Some studies suggest that the availability of NICU services is unrelated to population needs.^{22–24}

This article describes the perinatal health-care system related to maternity and newborn hospitals in local communities, focusing on the number of hospitals by levels of care; linkages among hospitals and the nature of these linkages; and their relation to state guidelines for perinatal care. Changes in the number of hospitals and their effect on relationships among perinatal providers in the community also are presented. Components of the perinatal health services system and collaborations among hospitals and providers were specifically assessed in local communities for this study as part of a larger nationwide evaluation of Fetal and Infant Mortality Review (FIMR) programs.

METHODS

Data for this study were obtained from interviews conducted nationwide with respondents in local health departments (LHDs), who were responsible for or knowledgeable about maternal and child health (MCH) programs, practices, and policy in their community from 1996 to 1999. As the larger study focused on communities with and without FIMR programs, the design was a cross-sectional observational study in which geographic units were sampled based on the presence or absence of a FIMR or other perinatal systems initiative (PI), geographic area of the country, and population density. The objective of the design was to identify

adequate numbers of communities with a FIMR or PI as well as those without these programs.

To draw the study sample, US counties and metropolitan areas were divided into four types of communities, using data collected from a survey of state and metropolitan MCH directors, and information from the National FIMR Program (NFIMR) about FIMRs. The four types of communities were those with: (1) neither a FIMR nor a PI; (2) a FIMR only; (3) a PI only; and (4) both types of programs. Other factors considered in sample selection were: geographic region (East, Midwest, South, West); state representation (at least one community was selected from each state in the US); and population density. Within the four geographic regions and using FIMR communities as the frame of reference for selecting communities with similar population density, we sampled 254 communities (204 counties and 50 metropolitan areas), assuming that an 80% response rate would yield about 200 communities. The sample for which data are reported here include 188 communities; 35% had neither a FIMR program nor a PI; 24% a FIMR only; 18% a PI only; and 23% both programs.

For each community, an LHD representative, who was responsible for MCH activities, was contacted to participate in a telephone interview. They were selected because they were assumed to have a population perspective with regard to public health activities and perinatal health services and systems in the community. We completed interviews with LHD personnel in 76% ($N = 193$) of the eligible sample communities. A total of 188 respondents completed the items in the interview about hospitals in their community.

Among the 188 LHD respondents for which hospital data were available, close to 80% held an administrative/management position in the LHD. The vast majority had worked in health for over 20 years (69%) and in perinatal health for more than 10 years (70%); over two-thirds had worked at the health department for over 10 years, and half in their current position for at least 6 years. Over 90% of the respondents held a bachelors degree or higher and half had advanced training in public health. Although we cannot tell how many respondents were former clinicians, we know from responses about educational attainment that at least one-third of the sample included physicians and nurses. It is likely that additional nurses participated who could not be identified because they reported their highest level of education as a nonspecified bachelors or masters degree.

The content of the LHD questionnaire pertinent to the data reported here was developed based on literature about systems of perinatal health care in states and local communities. Moreover, input was obtained on draft questionnaires from federal and state MCH staff, American College of Obstetricians and Gynecologists (ACOG) representatives, and other perinatal health researchers. The questionnaire included the following relevant content areas: (1) number of hospitals by level of care located within the local community; (2) linkages among community hospitals as well as

with subspecialty (Level III) hospitals outside the community; (3) the components of the hospital linkages; (4) relationships among clinical and other health-related service agencies and providers in the community; and (5) the presence of state guidelines for the level of perinatal health services in hospitals for 1996 to 1999. Many questions used for this study were included as background to measure the perinatal health systems context in communities in which FIMR programs and other perinatal systems initiatives were implemented.

The analysis of the data from the LHD respondents reported here had two objectives. The first was to describe the organization of hospital-based services in local areas including: the number of hospitals by level; changes in hospital numbers by level; linkages among hospitals and the components of these linkages related to obstetric and newborn care; changes in the relationships among providers for high-risk mothers and newborns; and the use of state guidelines to designate the level of care in maternity and newborn hospitals.

The second objective involved studying whether factors such as state guidelines were related to linkages among hospitals, and whether changes in the number of hospitals in the community had an effect on relationships among providers in the community. We also evaluated whether or not the type of linkages among hospitals had an effect on specific relationships among providers. We hypothesized that associations between changes in hospital numbers and changes in provider relationships were likely to occur where linkages have existed, but not where there was no linkage. The χ^2 test for independence was used to test the significance of these differences based on a *p*-value of 0.05 or less.

RESULTS

The communities represented in the study sample were distributed across the country in five regional groupings reflecting differences in the orientation of health departments and health services systems in addition to geographic location. The highest percentage of communities was located in Southeastern states (30%) and the lowest in Central (15%) and Western Coastal States (14%), with the remainder roughly equally divided between the North East and Western/Plain states. Close to half of the communities were

counties or metropolitan areas with populations over 250,000 persons; 18% had populations above 1 million and 29%, populations between 250,000 and 999,999. Close to 14% of the "local communities" encompassed multiple counties or metropolitan areas as the smallest geographic unit at which the local health agency operated. The remaining communities were evenly divided among those with populations between 20,000 and 249,000 and those with less than 20,000 persons.

There was at least one hospital that provided maternity care in all but 12 sample communities (Table 1). About one-third of the communities did not have a Level I hospital, half had no Level II hospitals, and 43% had no Level III/IV hospitals. In our survey, Level I hospitals were also characterized as community hospitals, Level II as specialty hospitals, Level III as subspecialty hospitals, and Level IV as regional hospitals. Respondents were asked to report separately about the number of subspecialty and regional hospitals because of variations in state guidelines related to levels of care; these hospitals were combined in the analysis because of small numbers and the unclear distinction between them in the type of clinical care they provided. In the 48 communities with only one maternity hospital, 52% were Level I hospitals and the majority of the remainder, Level III/IV hospitals (data are not displayed in Table 1).

Data were reported by the LHD respondents about whether or not there generally were state guidelines for the level of perinatal health care provided in maternity and newborn hospitals, and whether or not the guidelines were formal or informal (no other information was specified about the guidelines). In all, 63% reported that levels of care were designated by state guidelines, the vast majority (79%) of which were formal.

In three-quarters of the communities, linkages were reported among all hospitals providing maternity and newborn care; 62% of these were reported to be formal linkages. Linkages between nontertiary and tertiary hospitals, regardless of where the tertiary hospital(s) was located, were reported in 65% of communities; 65% of these linkages were formal. The specific nature of the linkages for all pregnant women and newborns was assessed in the 139 communities reporting linkages among any hospitals. In about two-thirds of these communities, linkages included agreements about obstetric consultation and referral (69%), emergency transport of women in preterm labor (70%) and emergency

Table 1 Percentage and Number of Level I, Level II, Level III/IV and Total Hospitals Reported in the Study Communities (N=185)

Hospitals	None % (N)	One % (N)	Two % (N)	Three % (N)	Four or more % (N)	Do not know % (N)
Level I	32.4 (60)	28.1 (52)	11.9 (22)	9.7 (18)	9.2 (17)	8.6 (16)
Level II	50.8 (94)	23.8 (44)	5.4 (10)	3.8 (7)	6.5 (12)	9.7 (18)
Level III/IV	42.7 (79)	21.6 (40)	11.9 (22)	8.6 (16)	7.0 (13)	8.1 (15)
Total	6.5 (12)	25.9 (48)	17.3 (32)	13.0 (24)	37.3 (69)	0.0 (0)

transport of women with complications (66%). In approximately three-quarters of the communities, LHD respondents reported that linkages involved agreements about pediatric or NICU consultation (74%) or about emergency transport of medically high-risk newborns (74%). Linkages included agreements about back transport in only half of the communities (50%).

Table 2 shows the percentage of communities in which LHD respondents reported linkages among all community hospitals providing maternity care and linkages among nontertiary and tertiary hospitals by whether or not levels of hospital care were designated by state guidelines. Linkages among hospitals were strongly related to the presence of state guidelines for designation of the level of perinatal care. While there were linkages among all maternity and newborn hospitals in 55% of communities with no state guidelines and 60% where the status of the guidelines was unknown, linkages were reported in 87% of communities with state guidelines. The respective percentages for linkages among

nontertiary and tertiary hospitals according to the status of the state guidelines were 45, 45, and 76%. These differences were statistically significant.

The results in Table 3 show that the differences in hospital linkages between communities with and without state guidelines for levels of care persisted for all types of linkages — obstetric consultation and referral, maternal transport, neonatal consultation, and neonatal transport — although the differences were somewhat reduced for back transport of newborns. Linkages among hospitals were not related to the number of hospitals in the community or the location of the nearest tertiary hospital (data not presented).

Changes in the number of hospitals providing perinatal care occurred in 49 communities (26%) (Table 4); in some communities, more than one change was reported by the LHD respondent. In the 31 communities in which there was a change in the number of Level I hospitals, two-thirds of the changes were

Table 2 Percentage and Number of Communities with Linkages among all Maternal and Newborn Hospitals and among Nontertiary and Tertiary Hospitals by Whether or Not Levels of Hospital Care were Designated According to State Guidelines

State guidelines for hospital designation	Linkages		
	Among all hospitals* % (N)	Among nontertiary and tertiary hospitals* % (N)	Total (N) [†]
No	54.8 (17)	45.2 (14)	31
Yes	86.6 (103)	76.5 (91)	119
Do not know	60.5 (23)	44.7 (17)	38
Total	76.1 (143)	64.9 (122)	188

* $p < 0.001$.
[†]Denominator for the percentage of communities with linkages.

Table 3 Percentage and Number of Communities in which Types of Linkages were reported among Hospitals by State Guideline for Levels of Health Care

Type of linkage	State guidelines		
	Yes % (N)	No or unknown % (N)	Total % (N)
Obstetrics consultation and referral*	77.2 (88)	48.9 (23)	68.9 (111)
Emergency transport of women in preterm labor*	78.9 (90)	46.8 (22)	69.6 (112)
Emergency transport of women with complications*	95.4 (86)	44.7 (21)	66.5 (107)
Pediatric or NICU consultation*	81.6 (93)	55.3 (26)	73.9 (107)
Emergency transport of high-risk newborns*	83.3 (95)	53.2 (25)	74.5 (120)
Back transport of newborns [†]	57.0 (65)	34.0 (16)	50.3 (81)
Total N [‡]	144	47	161

* $p < 0.01$.
[†] $p < 0.001$.
[‡]Denominator for the percentage of communities with each type of linkage.

Table 4 Percentage and Number of Respondents Reporting a Change in the Number of Hospitals and Whether or Not the Change was an Increase or Decrease in the Number of Hospitals in their Community

Hospitals	Change in the number of hospitals %	Total (N) [*]	Type of change			
			Increase % (N)	Decrease % (N)	Not specified % (N)	Total (N) [†]
Level I	16.5	188	29.0 (9)	67.7 (21)	3.2 (1)	31
Level II	9.0	188	52.9 (9)	41.2 (7)	5.9 (1)	17
Level III/IV	4.8	188	55.6 (9)	44.4 (4)	0.0 (0)	9
Total	26.1	188	32.7 (16)	57.1 (28)	10.2 (5) [‡]	49

^{*}Denominator for percentage of communities where there was a change in the number of hospitals.

[†]Denominator for the percentage of communities with a change in hospital numbers in which there was a decrease or increase.

[‡]Includes three communities in which there was both a decrease and increase in the number of hospitals.

Table 5 Percentage and Number of Communities with a Change in Relationships among Providers for Care to High-Risk Pregnant Women and Newborns and Type of Relationship by Whether or Not there was a change in the Number of Hospitals

Changes in	Changes in the number of hospitals		
	Yes % (N)	No % (N)	Total % (N)
Relationships of providers for high-risk women [*]	30.6 (15)	12.2 (17)	17.0 (32)
Emergency transport for high-risk women [*]	26.5 (13)	7.2 (10)	12.2 (23)
Relationships of providers for high-risk newborns [†]	24.5 (12)	10.8 (15)	14.4 (27)
Emergency transport for high-risk newborns [†]	22.4 (11)	10.1 (14)	13.3 (25)
Relationships of providers for high-risk women to social services	34.7 (17)	30.9 (43)	31.9 (60)
Total N [‡]	49	139	188

^{*} $p < 0.01$.

[†] $p < 0.05$.

[‡]Denominator for percentage of communities with a change in relationships.

decreases. For the 26 communities in which there were changes in the number of Level II or Level III/IV hospitals, over half of the LHD respondents reported increases in the numbers of hospitals.

Changes in the number of hospitals in the community were related to changes in provider relationships regarding referrals and transport of medically high-risk mothers and newborns (Table 5); for example, 31% of respondents in communities where a change occurred in the number of hospitals reported a change in referral relationships among providers for high-risk women compared with 12% in communities with no change in hospital numbers. Changes in the number of hospitals were not, however, related to changes in relationships among providers with regard to referrals of women for psychosocial services. These findings are not surprising as referral and transport are hospital-related services, but psychosocial services are more likely to be provided in outpatient services or by community agencies. Nevertheless, while 32% of LHD respondents reported that there was a change in the relationship among

providers with regard to referrals of women to psychosocial services, the percentage reporting changes among providers who cared for medically high-risk women and newborn was much lower, ranging from 12 to 17%.

Table 6a shows the percentage of communities in which LHD respondents reported changes in relationships among providers for high-risk women with regard to both referral and emergency transport by whether or not there were changes in the number of Level I, II, or III/IV hospitals. Changes in referral and transport relationships among providers for medically high-risk women were significantly related to changes in the number of Level I and Level II hospitals in the community, but not to changes in Level III/IV hospitals (Table 6a). The difference was greatest between communities with no change (12 and 7%, respectively, reporting changes in relationships related to obstetric referrals and maternal transport) and those where there was a change in the number of Level II hospitals (the respective percentages for relationships

Table 6 Percentage and Number of Communities with a Change in Referral or Transport Relationships among Providers for (a) Medically High-Risk Pregnant Women and (b) Medically High-Risk Newborns by Changes in the Number of Birthing Hospitals at Level I, Level II and Level III/IV Hospitals

Changes in the number of birthing hospitals	Changes in relationships of providers for high-risk women with regard to*:		
	Referrals % (N)	Emergency transport % (N)	Total (N) [†]
(a) Medically high-risk pregnant women			
Level I hospitals	29.0 [‡] (9)	25.8 [§] (8)	31
Level II hospitals	47.1 [¶] (8)	41.2 [¶] (7)	17
Level III/IV hospitals	33.3 (3)	11.1 (1)	9
No changes	12.2 (17)	7.2 (10)	139
Total N	17.0 (32)	12.2 (23)	188
Change in the number of birthing hospitals	Changes in relationships for providers of high-risk newborns with regard to*:		
	Referrals % (N)	Emergency Transport % (N)	Total (N)
(b) Medically high-risk newborns			
Level I hospitals	19.4 (6)	19.4 (6)	31
Level II hospitals	47.1 (8) [¶]	41.2 (7) [¶]	17
Level III/IV hospitals	33.3 (3)	33.3 (3)	9
No changes	10.8 (15)	10.1 (14)	139
Total N	14.4 (27)	13.3 (25)	188

*Comparisons are made between communities with no change in the number of hospitals and those with a change at each level of hospital.
[†]Denominator for the percentage reporting changes in relationships of providers of high-risk women with regard to referrals and emergency transports.
[‡] $p < 0.05$.
[§] $p < 0.01$.
[¶] $p < 0.001$.
^{||}Denominator for the percentage reporting changes in relationships of providers of high-risk newborns with regard to referrals and emergency transports.

related to referral and transport were 47 and 41%). This greater variation for Level II hospitals was also noted for changes in the relationship among providers concerning referral and emergency transport of high-risk newborns (Table 6b).

Table 7a shows the percentage of communities in which there was a change in provider relationships with regard to maternal referrals and transport by whether or not there was a change in the number of hospitals and whether or not there were linkages among hospitals. Changes in the relationships among providers for medically high-risk women were significantly associated with changes in the number of hospitals only in communities where there were established linkages among hospitals with respect to the transport of women in preterm labor, transport of women with other pregnancy complications, and obstetric referral and consultation (Table 7a). Similarly, changes in relationships among providers for high-risk newborns were related to changes in the number of hospitals only where there were established relationships related to emergency transport of high-risk newborns, intensive-care consultation and referral, and back transport of infants (Table 7b). Linkages among hospitals with respect to consultation or transport of medically high-risk women were not related to changes in relationships among providers of high-risk newborn care, and vice versa (data not shown).

Table 8 shows the effect of increases or decreases in the number of hospitals on changes in the relationships among providers for medically high-risk women and newborns by level of hospital. Changes in relationships among providers with regard to referrals and emergency transport for women and newborns were reported more frequently only in communities where there was a decrease in the number of hospitals. The effect of decreases in the number of hospitals was quite dramatic for Level II hospitals for relationships among providers of women and newborns alike. For Level I hospitals, the effect was more modest for relationships among providers for high-risk women, and was not statistically significant for providers for high-risk newborns.

DISCUSSION

Our study findings indicate that there were changes in the number of maternity-care hospitals in at least one-quarter of the sample communities, and that some of these changes were accompanied by changes in relationships among providers for medically high-risk care for pregnant women and newborns. The changes in relationships occurred in communities where there were decreases in the number of hospitals, and the effect was greatest for decreases

Table 7 Percentage and Number of Communities with a Change in Referral or Transport Relationships for (a) Medically High-Risk Women and (b) Medically High-Risk Newborns by Change in the Number of Hospitals and Type of Hospital Linkage

(a) Medically high-risk women				
Hospital linkage related to:	Change in relationships of providers for high-risk women with regard to			
	Referrals Change in hospital numbers		Transport Change in hospital numbers	
	Yes % (N)	No % (N)	Yes % (N)	No % (N)
Transport of women in preterm labor				
Linkage	40.6 (13) ^{*,†}	12.5 (10)	40.6 (13) ^{‡,*}	10.0 (8)
No linkage	11.8 (2)	11.9 (7)	0.0 (0)	3.4 (2)
Transport of women with complications				
Linkage	44.8 (13) ^{‡,§}	11.5 (9)	41.4 (12) ^{*,§}	11.5 (9)
No linkage	10.0 (2)	13.1 (8)	5.0 (1)	1.6 (1)
Obstetric referral and consultation				
Linkage	37.5 (12) [*]	15.0 (9)	37.5 (12) ^{*,§}	8.9 (7)
No linkage	17.6 (3)	10.1 (8)	5.9 (1)	5.0 (3)
(b) Medically High-Risk Newborns				
Hospital linkage related to:	Change in relationships of providers for high-risk newborns with regard to:			
	Referrals change in hospital numbers		Transport change in hospital numbers	
	Yes % (N)	No % (N)	Yes % (N)	No % (N)
Emergency transport of high-risk infants				
Linkage	28.6 (10) ^{*,}	12.9 (11)	28.6 (10) [¶]	12.9 (11)
No linkage	14.3 (2)	2.4 (4)	7.1 (1)	5.6 (3)
Intensive care consultation and referral				
Linkage	32.4 (11) [¶]	15.3 (13)	32.4 (11) [¶]	12.9 (11)
No linkage	6.7 (1)	3.7 (2)	0.0 (0)	5.6 (3)
Back transport of newborns				
Linkage	34.8 (8)	15.5 (9)	34.8 (8) [¶]	13.8 (8)
No linkage	15.4 (4)	7.4 (6)	11.5 (3)	7.4 (6)
<p>The first superscript refers to test of significance between communities with and without linkages. The second refers to tests between hospitals with and without changes in the community.</p> <p>[*]$p < 0.01$.</p> <p>[†]The (N) here is the number of communities in which there was a change in provider relationships regarding referrals of high-risk women in communities where there also was a change in the number of hospitals and where there were linkages related to the transport of women in preterm labor.</p> <p>[‡]$p < 0.001$.</p> <p>[§]$p < 0.05$.</p> <p>[¶]$P < 0.05$ for comparisons between communities with and without linkages.</p> <p>The (N) here is the number of communities in which there was a change in provider relationships regarding referrals of high-risk newborns in communities where there also was a change in the number of hospitals and where there were linkages related to the emergency transport of high-risk infants.</p>				

in Level II hospitals. There was no effect of increases in the number of hospitals or for changes in the number of Level III/IV hospitals. Moreover, declines in the number of hospitals influenced changes in relationships among providers only in communities with established linkages among hospitals. These changes affected

relationships among providers for high-risk women only where linkages involved the care for medically high-risk women; that is, there was no evidence of an association for women where linkages involved care for high-risk infants. Similar findings were noted specific to the care for high-risk newborns. Changes in the number

Table 8 Percentage and Number of Communities with Changes in the Relationships of Providers for Medically High-Risk Women and Newborns by Whether or Not There was an Increase or Decrease in the Number of Level I and Level II Hospitals in the Community

Changes in relationships among providers with regard to	Change in the number of hospitals [*]			Total % (N)
	Increase % (N)	Decrease % (N)	No change	
<i>Level I hospitals</i>				
Referrals of high-risk women	11.1 (1)	38.1 (8)	16.1 (14)	19.5 (23)
Emergency transport of high-risk women	11.1 (1)	33.3 (7) [*]	10.3 (9)	14.4 (17)
Referrals of high-risk newborns	22.2 (2)	19.0 (4)	16.1 (14)	16.9 (20)
Emergency transport of high-risk newborns	22.2 (2)	19.0 (4)	12.6 (11)	14.4 (17)
Total N [†]	9	21	87	118
<i>Level II hospitals</i>				
Referrals of high-risk women	33.3 (3)	71.4 (5) [‡]	13.8 (8)	21.6 (16)
Emergency transport of high-risk women	22.2 (2)	71.4 (5) [§]	6.9 (4)	14.9 (11)
Referrals of high-risk newborns	33.3 (3)	71.4 (5) [‡]	12.1 (7)	20.3 (15)
Emergency transport of high-risk newborns	33.3 (3)	57.1 (4) [*]	13.8 (8)	20.3 (15)
Total N [†]	9	7	58	74 [¶]

^{*} $p < 0.05$.
[†]Denominator for the percentage of communities with changes in relationships among providers for increases, decreases or no change in number of hospitals in community.
[‡] $p < 0.01$.
[§] $p < 0.001$.
[¶]Excludes communities where no information was available about whether there was a decrease or increase in the number of hospitals.

of hospitals did not affect relationships among providers serving high-risk women who needed psychosocial services. Thus, in an environment where collaborations have previously been established, decreases in the number of hospitals appear to affect provider relationships related specifically to medically high-risk pregnant women and newborns in the community.

State guidelines for designating levels of perinatal hospital care appear to have enhanced collaborations among local hospitals, regardless of the nature of these linkages. This finding may reflect the fact that collaboration must exist at the state level in order to establish guidelines and may ultimately influence collaborations at the local level as well. It may also reflect the underlying philosophy of a regional system that collaborations must exist at all levels for the system to work.

The results reported here must be viewed with some caution for several reasons. First, our sample of local communities is not representative of communities throughout the country. In particular, the manner in which the sample was drawn makes it likely that there was more activity related to perinatal health care and systems coordination in our study communities than in many communities in the United States. There was an FIMR program, perinatal systems initiative or both programs in close to two-thirds of the study communities. This oversampling of communities with considerable activity related to perinatal health may be one of the reasons for the high percentage of Level III/IV hospitals in the communities where the LHD respondent reported only one hospital.

There were differences noted in linkages among hospitals and changes in hospital numbers and provider relationships between

communities with neither an FIMR program nor other perinatal systems initiative and those with both or either program (data not presented here). These differences suggest that in communities with both, and to a lesser extent those with either program, a greater percentage of LHD respondents reported linkages among hospitals, and, not surprisingly, changes in provider relationships. Although there was more activity surrounding perinatal health in communities with these programs, they were not specific to either FIMR or other perinatal systems initiatives. Moreover, the presence or absence of an FIMR program in the community was not associated with the number of hospitals in total or at any given level of care.

The greater activity surrounding perinatal care in communities in which an FIMR program or PI was implemented may be a reason why a high percentage of LHD respondents (63%) reported that levels of hospital care were designated by state guidelines. This finding appears contrary to the results of a survey of state MCH programs conducted by Johnson and Little.²⁵ They reported that, except for a few states, involvement of the state health agency in regionalization of perinatal care was mostly passive and collaborative rather than active and regulatory.²⁵ In our survey, however, we did not ask about involvement of the state health agency in setting guidelines, but rather if there were any state guidelines, regardless of their origin.

A second limitation of our study is the use of only one respondent from the LHD to provide data about the entire perinatal health-care system, public and private alike. While the respondents are likely to have a broad view of the perinatal health-care system and publicly available services in their communities, they may be

less informed about the private sector, especially about changing relationships among private providers. Nevertheless, the respondents to the survey were highly educated and experienced, and the vast majority had been with the LHD for over 10 years and in their current position for at least 6 years. In our previous work on the organization of perinatal health services, state MCH directors provided quite detailed information about the organization of perinatal health services and regional infrastructures in their state. LHD professionals may be even more likely than state officials to have good knowledge of the organization of services in their local communities.²⁶

A third limitation of the study is related to the small number of communities in which a change occurred in the number of hospitals, particularly when further classified by level of care of the hospital and whether the change was an increase or decrease in numbers. Despite these small numbers, the results are quite convincing with regard to the effect of decreases in the number of Level I and Level II hospitals on relationships among providers. A final limitation is the cross-sectional nature of the study in which the respondent was asked to report about events in the last 4 years (1996 to 1999); a longer time period may have yielded more reports of changes.

The findings of our study must be viewed within the larger context of changes in the health-care system. With increasing pressures to reduce Medicaid costs and to increase access to services for low-income women, many states have recommended or required managed care for the Medicaid population.²⁷ Enrollment in a managed care plan also has increased among women with private insurance. In the Kaiser Women's Health Survey, slightly over 80% of both privately insured women and women on Medicaid reported that they were enrolled in some type of managed care plan in 2001.²⁸

There are limited data available to support or refute whether or not ever-changing managed care alliances disrupt existing networks of perinatal services and providers; yet managed care is often described as a factor in anecdotal reports from providers and public health professionals about difficulties in maintaining stable health-care networks in a community. Managed care appears to have only a modest effect on how health-care organizations deliver medical care²⁹ despite the profound effect that it has on how providers are organized. Moreover, in Washington State, increasing penetration of managed care may have had an impact on decreases in the percentage of LBW infants born in Level III hospitals between 1989 and 1993; these declines, however, were reversed by 1996. The percentage of VLBW babies born in Level III hospitals, however, did not change over the study period, despite increases in HMO penetration.²¹

The organizational changes taking place with regard to managed care appear to focus primarily on merging the business functions of health-care organizations rather than clinical activities, although availability of specific types of providers or services also is important.³⁰ In our study, managed care was

seldom reported as the reason for changes in the number of hospitals in a community, based on qualitative data we collected about the reasons for these changes. Many of the reasons given were due to financial or business-related issues. The most frequently reported reason for a decrease in the number of Level I hospitals was because of financial reasons (38%) that the maternity service was too small or did not have enough births per year (33%) or because of mergers or consolidations (18%). Financial reasons (29%) and consolidation (43%) also were frequently given as reasons for decreases in the number of Level II hospitals. The reasons reported for increases in the number of Level II hospitals included the need for more advanced care (56%) and market share for perinatal services (22%). These same reasons were reported where there were increases in Level I hospitals (22% for needed care and 33% for market share).

With regard to perinatal services, it has been argued that development of a full-service hospital is seen as a marketing advantage because the availability of NICU care is attractive to pregnant women, and women tend to continue to use the same facility for health care for the family after birth.^{8,31–34} We had expected to find that Level II hospitals might have been redesignated as Level III hospitals to gain this advantage. Our findings, however, indicate that a decrease in the number of Level II hospitals was accompanied by an increase in the number of Level III/IV hospitals in only one community. More importantly, an increase in the number of Level II or Level III/IV hospitals did not have an effect on changes in relationships among providers.

Although changing relationships among hospitals have been reported for specific states^{5,7} and within a state,¹² our study is the first to report on changing numbers of hospitals and relationships among providers of perinatal care in local communities nationwide. The findings indicate that changes in the number of facilities in a community, specifically decreases, had an impact on relationships among providers in communities where there were previously established linkages among facilities, but they did not have an effect on provider relationships where linkages did not previously exist. They also suggest that there was flux in the health-care system that may affect where and from whom pregnant women and newborns receive their health care. Our findings do not, however, provide any direct evidence about the influence of changes in hospital numbers or changes in relationships among providers on the quality of perinatal care in communities.

Acknowledgements

We acknowledge the State and local public health officials and FIMR and perinatal initiative coordinators who participated in this study. Their willingness to share information through telephone interviews about the important work they are doing required a significant commitment of time, expertise, and effort — we remain in their debt. We also acknowledge the sage advice provided by Ann Koontz on all aspects of the research reported here.

References

- McCormick MC, Shapiro S, Starfield BH. The regionalization of perinatal services. Summary of the evaluation of a national demonstration program. *JAMA* 1985;253(6):799–804.
- Sinclair JC, Torrance GW, Boyle MH, Horwood SP, Saigal S, Sackett DL. Evaluation of neonatal-intensive-care program. *N Engl J Med* 1981;305(9):489–94.
- Mayfield JA, Rosenblatt RA, Baldwin LM, Chu J, Logerfo JP. The relation of obstetrical volume and nursery level to perinatal mortality. *Am J Public Health* 1990;80(7):819–23.
- Cifuentes J, Bronstein J, Phibbs CS, Phibbs RH, Schmitt SK, Carlo WA. Mortality in low birth weight infants according to level of neonatal care at hospital of birth. *Pediatrics* 2002;109(5):745–51.
- Powell SL, Holt VL, Hickok DE, Easterling T, Connell FA. Recent changes in delivery site of low-birth-weight infants in Washington: impact on birth weight-specific mortality. *Am J Obstet Gynecol* 1995;173(5):1585–92.
- Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. The effects of patient volume and level of care at the hospital of birth on neonatal mortality. *JAMA* 1996;276(13):1054–9.
- Yeast JD, Poskin M, Stockbauer JW, Shaffer S. Changing patterns in regionalization of perinatal care and the impact on neonatal mortality. *Am J Obstet Gynecol* 1998;178(1 Part 1):131–5.
- Menard MK, Liu Q, Holgren EA, Sappenfield WM. Neonatal mortality for very low birth weight deliveries in South Carolina by level of hospital perinatal service. *Am J Obstet Gynecol* 1998;179(2):374–81.
- Committee on Perinatal Health. Toward improving the outcome of pregnancy: recommendations for the regional development of maternal and perinatal health services (TIOP I), March of Dimes Birth Defects Foundation, 1976.
- Committee on Perinatal Health. Toward improving the outcome of pregnancy: the 90s and beyond (TIOP II), March of Dimes Birth Defects Foundation, 1993.
- Guidelines for Perinatal Care. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; Washington, DC: American College of Obstetricians and Gynecologists; 1997.
- Lessaris KJ, Annibale DJ, Southgate WM, Hulsey TC, Ohning BL. Effects of changing health care financial policy on very low birthweight neonatal outcomes. *South Med J* 2002;95(4):426–30.
- Horbar J, Lucey J. Evaluation of neonatal intensive care technologies. *Future of Children* 1995;5(1):139–61.
- McCormick MC, Richardson DK. Access to neonatal intensive care. *Future of Children* 1995;5(1):162–75.
- Pollack LD, Ratner IM, Lund GC. United States neonatology practice survey: personnel, practice, hospital, and neonatal intensive care unit characteristics. *Pediatrics* 1998;101(3 Pt 1):398–405.
- Bode MM, O'Shea T M, Metzguer KR, Stiles AD. Perinatal regionalization and neonatal mortality in North Carolina, 1968–1994. *Am J Obstet Gynecol* 2001;184(6):1302–7.
- Hein HA. Regionalization of perinatal health care: a lesson learned but lost. *J Perinatol* 1999;19(8 Pt 1):584–8.
- Friedman B, Devers KJ, Steiner CA, Fox S. The use of expensive health technologies in the era of managed care: the remarkable case of neonatal intensive care. *J Health Polit Policy Law* 2002;27(3):441–64.
- Mehta S, Atherton HD, Schoettker PJ, Hornung RW, Perlstein PH, Kotagal UR. Differential markers for regionalization. *J Perinatol* 2000;20(6):366–72.
- Gagnon DE. Managing the future: an examination of the neonatal intensive care unit. *J Perinatol* 1991;11(2):168–71.
- Gerber SE, Dobrez DG, Budetti PP. Managed care and perinatal regionalization in Washington State. *Obstet Gynecol* 2001;98(1):139–43.
- Goodman DC, Fisher ES, Little GA, Stukel TA, Chang CH. The uneven landscape of newborn intensive care services: variation in the neonatology workforce. *Eff Clin Pract* 2001;4(4):143–9.
- Goodman DC, Fisher ES, Little GA, Stukel TA, Chang CH. Are neonatal intensive care resources located according to need? Regional variation in neonatologists, beds, and low birth weight newborns. *Pediatrics* 2001;108(2):426–31.
- Howell EM, Richardson D, Ginsburg P, Foot B. Deregionalization of neonatal intensive care in urban areas. *Am J Public Health* 2002;92(1):119–24.
- Johnson K, Little G. State health agencies and quality improvement in perinatal care. *Pediatrics* 1999;103(1):233–47.
- Strobino D, Grason H, Koontz A, Silver G. Reexamining the organization of perinatal services systems: a preliminary report, Women's and Children's health Policy Center, June, 2000.
- Health Care Financing Administration. A Profile of Medicaid: Chart Book 2000, September, 2000.
- Salgonicoff A, Beckerman J, Wyn R, Ojeda V. Women's Health in the United States: health coverage and access to care, The Henry J. Kaiser Family Foundation, UCLA Center for Health Policy Research, May 2002.
- Roblin DW, Richardson DK, Thomas E, et al. Variation in the use of alternative levels of hospital care for newborns in a managed care organization. *Health Serv Res* 2000;34(7):1535–53.
- Lesser CS, Ginsburg PB. Update on the nation's health care system: 1997–1999. *Health Aff (Millwood)* 2000;19(6):206–16.
- Coile Jr RC. Obstetrics: strategic centerpiece of "full service" hospitals in the 1990s. *Hosp Strategy Rep* 1990;2(12):1, 3–4.
- Lofgren MA. Development of a resource manual for returning neonates to community hospitals. *Neonatal Netw* 1999;18(4):29–33.
- Kohn L. Organizing and Managing Care in a Changing Health System. *Health Services Res* 2000;35(1, Part 1):37–52.
- Hein HA, Lofgren MA. The changing pattern of neonatal mortality in a regionalized system of perinatal care: a current update. *Pediatrics* 1999;104(5 Part 1):1064–9.