PLANNED HOME BIRTHS

Outcomes Among Medicaid Women in Washington State

Washington State
Department of
Social and Health Services
Budget Division
Office of Research &
Data Analysis

PLANNED HOME BIRTHS:
Outcomes Among Medicaid Women in Washington State

Laurie Cawthon, M.D., M.P.H.

July 1996

First Steps Database
Office of Research and Data Analysis
Department of Social and Health Services
Olympia, Washington 98504-5204

DEPARTMENT OF SOCIAL AND HEALTH SERVICES

Lyle Quasim, Secretary

BUDGET DIVISION

Wolfgang Opitz, Ph.D., Director

OFFICE OF RESEARCH AND DATA ANALYSIS

Timothy R. Brown, Ph.D., Chief

In Conjunction with
DEPARTMENT OF HEALTH

Bruce Miyahara, Secretary

FIRST STEPS WORK GROUP

Ros Aarthun, Laura-Mae Baldwin, Linda Barret, Tom Bell, Amandalei Bennett, Andrew Brunskill, Sherilynn Casey, Laurie Cawthon, Dan Conlon, Maura Craig, Susan Fleskes, Jim Gaudino, Toni Krupski, Diana Larsen-Mills, Lenore Lawrence, Dinah Martin, Sharon McAllister, Jan Rabkin, Florence Reeves, Nancy Reid, Laura Schrager, Stacey Schubert, Ginny Spenkle, Diane Tiffany, Joan Treacy, Peter Vennewitz, Jeff Willis, Susanne Windels, Steve Wish

PLANNED HOME BIRTH AND
MEDICAID REIMBURSEMENT TASK FORCE

Eric Houghton, MD, Sarah Huntington, LM, Kendra Johnson, Mary Looker, Annette Manant, BSN, ARNP, CNM, Polly Taylor, CNM, MPH, ARNP, Marijke van Roojen, LM, Margaret Wilson, MN, ARNP

When ordering, please refer to Report 7.93

STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES

November 13, 1996

To: Interested Persons

From: Laurie Cawthon, M.D., M.P.H.
Project Manager, First Steps Database
Research and Data Analysis

Subject: Updated Information for *Planned Home Births* Report

In October 1996, we received the Matched Infant Death files for 1994 and 1995 from the DOH Center for Health Statistics. These data have allowed us to update the infant mortality data previously distributed in our report on *Planned Home Births*; we now have complete infant mortality data for children born in 1993 and 1994, two more years than available in July. While the new data do not change the general conclusions made in the report, fewer adverse outcomes were found among the 1993 and 1994 births, so the differences between outcomes for women who received some prenatal care from licensed midwives and other Medicaid women are smaller. This is shown most clearly in the revised Table 8 (from page 15 of the report) shown on the back of this page.

- The infant mortality rate for women who received prenatal care from licensed midwives is not significantly greater than that for all other Medicaid women. This finding is unchanged, but the difference between the IMRs is smaller than previously.

- No additional SIDS cases were identified among 1993 and 1994 births to women who received prenatal care from licensed midwives. The SIDS rates for the two groups are now very similar; again the difference was previously greater although not significant.

- The rate of major malformations (as previously defined) remains greater among the births to women with prenatal care from licensed midwives, and this difference continues to be statistically significant. The rate of major malformations is basically unchanged for the all other Medicaid group and is lower for the women with prenatal care from licensed midwives. Only one additional case (Down Syndrome) was identified among the 1993-94 births to women with prenatal care from licensed midwives.

The consistency of these findings is reassuring and confirms the conclusions discussed in the report. It does suggest that the number of unusual birth defects found in the 1989-92 births is likely to represent a random occurrence although further monitoring may be indicated.

An inadvertent error occurred on page 20 of the report in the explanation of the meaning of statistical significance in the first sentence of the last paragraph. Page 20 has been corrected in this copy of the report.

Table 8. Rates of Infant Mortality and Major Malformations: 1989-1994 Births

Revised 11/96 to include 1993-1994 Infant Death Data

	Women with Some PNC from Lic. Midwives (N=2037	All Other Medicaid Women (N=167,799)	p-Value	Risk Ratio (95% Confidence Interval)
Infant Mortality Rate	10.3 per 1000 (n=21)	9.4 per 1000 (n=1571)	p=0.66	1.10 (0.72 to 1.69)
SIDS Rate	2.9 per 1000 (n=6)	3.1 per 1000 (n=516)	p=0.92	1.96 (0.43 to 2.14)
Rate of Major Malformations[1]	3.9 per 1000 (n=8)	1.8 per 1000 (n=299)	p=0.03	2.20 (1.09 to 4.44)

[1] Rates for major malformations (restricted to Down Syndrome, Trisomy 18, diaphragmatic hernia, and conjoined twins) include children who survived the first year of life.

ACKNOWLEDGMENTS

This report was prepared by the First Steps Database on request of the Planned Home Birth and Medicaid Reimbursement Task Force. The ideas, questions, and comments offered by that group were helpful in guiding the direction of inquiry in this study. The First Steps Work Group also provided helpful review and suggestions.

The entire staff of the First Steps Database participated in various phases of the preparation of this report. Devin Hopps, Research Analyst, performed nearly all of the programming tasks and data analysis and created the templates for data tables. Laura Schrager provided oversight for analysis and performed verification studies, and Vera Barga offered programming and coding advice and resolution of problems in analysis. Dan Nordlund and Stacey Schubert helped with editorial review and proof-reading. Trisha Keenan participated in discussions about the significance of the results, and Karen Thorson assisted with final layout of the report.

Tim Brown, Chief of the Office of Research and Data Analysis, provided oversight and overall project management.

Thanks go to Jane Dillon-Wingfield for her assistance with cover design and printing.

Special thanks go to Francia Reynolds and Greg Kirkpatrick for help in setting up computer workstations and maintaining the ORDA computer network, which supports the technical operation of the First Steps Database.

The First Steps Database would not exist without the contributions of the Department of Health Center for Health Statistics, which provides birth certificate data files, and the Medical Assistance Administration, DSHS, which provides Medicaid claims data.

Table of Contents

Acknowledgments iii
Table of Contents v
Executive Summary 1
Background 2
Study Methods 3
Findings
I. Birth Outcomes 7
II. Maternal Characteristics 8
III. Amount and Timing of Prenatal Services 13
IV. Infant Mortality and Major Malformations 15
Discussion 18
Conclusion 20
Bibliography 25

EXECUTIVE SUMMARY

Planned Home Births:
Outcomes Among Medicaid Women in Washington State

This study describes birth outcomes, maternal characteristics, and prenatal care for women with planned home births who gave birth between 1989 and 1994. Women with home births are compared to other women who received prenatal care from licensed midwives and gave birth in birthing centers or in hospitals. These groups are also compared to the general Medicaid population of women who gave birth. The First Steps Database was used to determine the specialty of prenatal care provider and the birth place type, and as the data source for other measures of interest.

Women who received prenatal care from licensed midwives were assumed to be planning (or at least considering) home birth. It was not possible in this study to determine the planning status (i.e., whether the birth place was planned to be at home) for women with home deliveries and a prenatal care provider other than a licensed midwife, and for this reason the study focused on women who received prenatal care from licensed midwives.

- Birth outcomes for home deliveries were striking for their very low rates of poor outcomes. For women who received prenatal care from licensed midwives, the majority (85% to 100%) of those who would subsequently deliver infants with poor outcomes were transferred for hospital delivery at some point prior to birth.

- Women who delivered at home and received prenatal care from licensed midwives were typically low risk with respect to established risk factors for adverse birth outcomes: they were mostly white, older, married, non-smokers, and highly educated. Many of the same risk factors may predict successful home delivery. Those who were successful in delivering at home tended to be older, even more highly educated, more non-smoking, and financially better off, compared to those who subsequently delivered in hospital. Women who delivered at home and received prenatal care from licensed midwives also demonstrated low risk characteristics regarding their use of prenatal care: they started prenatal care early in their pregnancies; women who delivered at home received considerably more prenatal care from licensed midwives than did women who delivered in hospital.

- For the women identified as receiving some prenatal care from licensed midwives, the infant mortality rate was nearly 1.5 times that for all other Medicaid women although this difference was not statistically significant. Major malformations and chromosomal abnormalities (Down Syndrome, Trisomy 18, diaphragmatic hernia, and conjoined twins) identified as causes of death or underlying medical conditions in the infant deaths occurred with a significantly higher frequency. This was not explained by the older age of the women with prenatal care from licensed midwives.

The results of this study are consistent with a large body of literature which has documented the safety of planned home birth for low risk women when attended by a trained provider.

Background

The Planned Home Birth and Medicaid Reimbursement Task Force requested the assistance of the First Steps Database in reviewing birth outcomes for Medicaid women who had planned home births. Previous reports from the FSDB described low rates of low birthweight and low prevalence of social and medical risk factors among women who received prenatal care from licensed midwives and certified nurse midwives[1] and identified the most frequent medical reasons for the birth attendant to be other than a licensed midwife as obstructed labor and multiple gestation among women who had some prenatal care from a licensed midwife.[2]

Washington State is one of fifteen states in the United States that currently license midwives who are not necessarily nurses to attend out-of-hospital.[3] With the implementation of the First Steps Maternity Care Access Program in 1989, Washington's Medical Assistance Administration began to reimburse licensed midwives for prenatal care; however, reimbursement for deliveries occurring at home has not been available. This issue was examined in 1992 by a previous task force, who recommended that DSHS reimburse for planned home births attended by physicians, certified nurse midwives and licensed midwives who agreed to function within proposed low risk guidelines. The committee also suggested that providers agree to participate in a quality assurance program for Medicaid reimbursed prenatal and home birth service.[4] Since such a quality assurance program has now been implemented, Medicaid is re-examining the issue of reimbursement for planned home births.

This report describes birth outcomes, maternal characteristics, and amount of prenatal care for women who received some prenatal care from licensed midwives and who gave birth between 1989 and 1994. Women who gave birth at home are compared to other women who received prenatal care from licensed midwives and who gave birth in birthing centers or in hospitals. These groups are also compared to the general Medicaid population of women who gave birth.

Women who begin prenatal care with licensed midwives are assumed to be planning (or at least considering) home birth. If they do not deliver at home or in a birthing center, it is assumed that, at some point, transfer of care has occurred. A woman who begins prenatal care with a licensed midwife may transfer her care to another provider (and subsequently deliver in hospital) for a number of reasons. She may choose to deliver in a hospital or birthing center because Medicaid reimburses for deliveries in these facilities. The midwife may recognize problems in the woman's pregnancy which contraindicate a home delivery and refer her care to a medical specialist. It is also possible that the woman may develop an acute condition prior to or during labor which requires emergency transfer. The methods used in this study do not permit distinguishing the timing of, and reasons for, transfer of care in detail, but the amount of prenatal care for which the midwife was reimbursed and the number of women who received care from other medical providers during the month prior to delivery were used to provide information in this area.

Study Methods

This study describes birth outcomes, maternal characteristics, and prenatal care use for 2,054 Medicaid women who gave birth between 1989 and 1994 and received some prenatal care from licensed midwives. The First Steps Database,[5] which links vital statistics, Medicaid claims, and eligibility data, was used as the data source for this study. The provider specialty on Medicaid claims for prenatal care services was used to identify women with prenatal care provided by licensed midwives, and the birth place type on the birth certificate was used to identify births which occurred at home. Other variables of interest were extracted from birth certificates, matched infant death records, Medicaid claims, and eligibility history files included in the First Steps Database.

The 2,054 births to women with prenatal care from licensed midwives were categorized by birth place type, and outcomes compared for women who delivered at home (N=706), in birthing centers (N=364), and in hospitals (N=811). These three groups accounted for 1,881 (91.5%) of the 2,054 births to women with prenatal care from licensed midwives. An additional 91 births (4.4%) occurred at home with a birth attendant other than a licensed midwife, and 82 births (3.9%) occurred in birth place types other than hospitals, home, or birthing centers. Only one of the births at other birth place types occurred en route. Because of the small size of these groups, these births were excluded from the analyses comparing birth place types.

Medicaid women represented 19.6% (1,409 / 7,181) of Washington's home births, while they were 36.3% of the total state births during the same time period. The majority (65%) of home births in Washington State during the six-year study period were attended by licensed midwives, as shown in Table 1 (below).

Table 1. Attendant at Birth for Washington Home Births 1989 - 1994

	Non-Medicaid N=5,772	Medicaid N=1,409
Licensed Midwife	3706 (64.2%)	920 (65.3%)
Physician	222 (3.8%)	164 (11.6%)
Certified Nurse Midwife	431 (7.5%)	30 (2.1%)
Nurse	91 (1.6%)	12 (<1%)
Other Midwife	176 (3.0%)	42 (3.0%)
Osteopath	7 (<1%)	5 (<1%)
Other	596 (10.3%)	132 (9.4%)
Not Stated	264 (4.6%)	44 (3.1%)

The 706 home births with prenatal care from licensed midwives represent half of the total number of home births to Medicaid women (N=1,409) during the same time period. Many home births are not planned to take place at home. In addition, some women who gave birth at home did not receive prenatal care from licensed midwives, and some women who received prenatal care from licensed midwives had a birth attendant other than a licensed midwife. The study groups were restricted to women with prenatal care from licensed midwives to control for the specialty of prenatal care provider and to exclude women with unplanned home births (based on the assumption that women with prenatal care from licensed midwives were planning home birth). The importance of excluding unplanned home births was based on previous findings that neonatal death rates for unplanned home births may be 18 to 20 times the rates for planned home births.[6, 7]

Overall, 1.5% of Washington births from 1989 through 1994 occurred at home, with a slightly greater proportion of home births in the Non-Medicaid population (1.9%) and a slightly lower proportion among Medicaid women (0.8%). Since 1989, the proportion of Medicaid deliveries with prenatal care provided by licensed midwives has been increasing as shown in Table 2.

Table 2. Medicaid Births with Prenatal Care Provided by Licensed Midwives

Year of Birth	Births with PNC from Licensed Midwives	Percent of All Medicaid Births
1989	137	0.66%
1990	219	0.84%
1991	311	1.06%
1992	353	1.14%
1993	470	1.46%
1994	564	1.78%
Total	**2,054**	

While the number of deliveries financed by Medicaid has increased over this time period (from 20,674 in 1989 to 31,569 in 1994), the proportion of deliveries with some prenatal care provided by licensed midwives has also increased: in 1989, just 0.66% of Medicaid births had prenatal care from licensed midwives; by 1994, the percentage had nearly tripled, increasing to 1.78%.

Comparison Groups

For analysis of birth outcomes, maternal characteristics, and amount and timing of prenatal care, the general Medicaid population of women who gave birth in 1992 was used. This year represents a midpoint in the six-year study period and is the most recent year for which certain data (infant deaths and mother's educational attainment) are available. Different measures may show varying trends over time so this comparison group was not used for the analysis of infant

mortality and major malformations. With more than 30,000 Medicaid births in 1992, the population was large enough to produce stable results.

Birth outcomes for women who received prenatal care from certified nurse midwives are also presented for comparison to a similar group who received prenatal care from licensed midwives. Births with prenatal care from certified nurse midwives (N=4,151), although a larger group than the group with prenatal care from licensed midwives, were drawn from the same six-year period as for the licensed midwives group.

The detailed analyses of rates of infant deaths and major malformations required a comparison group of Medicaid births which matched the same birth years as for the group of births with prenatal care from licensed midwives. These groups are described in more detail in Part IV.

Statistical Methods

SAS[8] was used for all data analysis and for t-tests. EPI-INFO[9] for used for other statistical tests and for the computation of confidence intervals. Differences were considered significant when the p-value was 0.05.

TABLE 3

BIRTH OUTCOMES FOR MEDICAID FUNDED BIRTHS WITH PRENATAL CARE PROVIDED BY LICENSED MIDWIVES

BIRTH OUTCOME	PRENATAL CARE PROVIDED BY LICENSED MIDWIFE Births from January 1989 - December 1994			ALL MEDICAID Births: 1992
	Home (Midwife Attended) (N = 706)	Birth Center (N = 364)	Hospital (N = 811)	(N = 30,938)
Total Liveborn (%Total Births)	**706** (100.0%)	**364** (100.0%)	**794** (97.9%)	**30,712** (99.3%)
Total Fetal Deaths (% Total Births)	**0** (0.0%)	**0** (0.0%)	**17** (2.1%)	**226** (0.7%)
Neonatal Deaths * (per 1000 Liveborn)	**1** (2.5)	**0** (0.0)	**7** (16.8)	**141** (4.6)
Post-Neonatal Deaths * (per 1000 Neonat. Survivors)	**2** (5.1)	**0** (0.0)	**6** (14.4)	**153** (5.0)
Infant Transferred (% Total Births)	**6** (0.8%)	**2** (0.5%)	**7** (0.9%)	**268** (0.9%)
Birthweight of Child				
Very Low (less than 1500 grams) (% Liveborn)	1 (0.1%)	0 (0.0%)	14 (1.8%)	345 (1.1%)
Medium Low (1500 - 2499) (% Liveborn)	6 (0.8%)	4 (1.1%)	55 (6.9%)	1,710 (5.6%)
Normal (2500+ grams) (% Liveborn)	699 (99.0%)	360 (98.9%)	719 (90.6%)	28,588 (93.1%)
Unknown (% Liveborn)	0 (0.0%)	0 (0.0%)	6 (0.8%)	69 (0.2%)
Number at Birth				
One (singleton) (% Total Births)	702 (99.4%)	362 (99.5%)	765 (94.3%)	30,266 (97.8%)
Two (twin) (% Total Births)	4 (0.6%)	2 (0.5%)	46 (5.7%)	654 (2.1%)
Three (triplet) (% Total Births)	0 (0.0%)	0 (0.0%)	0 (0.0%)	18 (0.1%)
Gestational Age				
Extremely immature (<28 weeks) (% Total Births)	0 (0.0%)	0 (0.0%)	16 (2.0%)	267 (0.9%)
Premature (28-36 weeks) (% Total Births)	9 (1.3%)	8 (2.2%)	96 (11.8%)	2,453 (7.9%)
Term/post-term (>36 weeks) (% Total Births)	697 (98.7%)	355 (97.5%)	682 (84.1%)	28,218 (91.2%)
Unknown (% Total Births)	0 (0.0%)	1 (0.3%)	17 (2.1%)	0 (0.0%)
Avg Cost of Infant Medical Care				
Mean 1st Year Medicaid Cost	$795	$844	$3,214	$3,068
Median 1st Year Medicaid Cost	$294	$415	$1,213	$1,257

* *Neonatal and post-neonatal death figures are given for January 1989 through December 1992 only. Rates for neonatal and post-neonatal deaths are calculated for live births by category from January 1989 through December 1992: Home =* ***395****, Birth Center =* ***124****, Hospital =* ***417****.*

Findings

I. Birth Outcomes

Table 3 describes birth outcomes among the three groups of women who received some prenatal care from licensed midwives. The rates of poor birth outcomes are very low among the women who delivered at home or in birthing centers. For each outcome studied — fetal mortality, neonatal and postneonatal mortality, low birthweight, and prematurity — the rate of poor outcomes was lower in the home-birth and birth-center groups, as compared to the general population of Medicaid women who gave birth. When outcomes are compared for women who received some prenatal care from a licensed midwife and delivered their baby in hospital, the rates of poor outcomes are generally higher than for women delivering in non-hospital settings or for the general Medicaid population.

The most striking findings are the very low rates of poor birth outcomes among women delivering at home or in birthing centers and the very high rates of in-hospital delivery for infants with poor birth outcomes born to women who received prenatal care from licensed midwives. The high rates of in-hospital delivery for infants with poor birth outcomes suggest that their mothers were selectively transferred at some point during pregnancy or labor. For example, the number of fetal deaths (stillbirths) among women who received some prenatal care from licensed midwives and delivered in non-hospital settings was zero (0). The rate of transfer to hospital delivery for these women who experienced fetal death was 100% (N=17). For other adverse outcomes, the transfer rates are also quite high:

Table 4. Transfer of Care from Midwife Practice to Hospital Delivery

Birth Outcome	Transferred for Hospital Delivery (Percent)
Fetal Death	100%
Very low birthweight	93%
Medium low birthweight	85%
Multiple Gestation (twins)	88%
Neonatal Death	88%
Prematurity (<37 weeks)	87%

TABLE 5

BIRTH OUTCOMES FOR MEDICAID FUNDED BIRTHS WITH PRENATAL CARE PROVIDED BY CERTIFIED NURSE MIDWIVES

BIRTH OUTCOME	PRENATAL CARE PROVIDED BY CERTIFIED NURSE MIDWIFE Births from January 1989 - December 1994			ALL MEDICAID Births: 1992
	Home (Nurse Attended) (N = 12)	Birth Center (N = 109)	Hospital (N = 4,030)	(N = 30,938)
Total Liveborn (%Total Births)	**12** (100.0%)	**109** (100.0%)	**4,009** (99.5%)	**30,712** (99.3%)
Total Fetal Deaths (% Total Births)	**0** (0.0%)	**0** (0.0%)	**21** (0.5%)	**226** (0.7%)
Neonatal Deaths * (per 1000 Liveborn)	**0** (0.0)	**0** (0.0)	**12** (4.5)	**141** (4.6)
Post-Neonatal Deaths * (per 1000 Neonat. Survivors)	**0** (0.0)	**1** (10.3)	**10** (3.8)	**153** (5.0)
Infant Transferred (% Total Births)	**0** (0.0%)	**4** (3.7%)	**39** (1.0%)	**268** (0.9%)
Birthweight of Child				
Very Low (less than 1500 grams) (% Liveborn)	0 (0.0%)	0 (0.0%)	35 (0.9%)	345 (1.1%)
Medium Low (1500 - 2499) (% Liveborn)	0 (0.0%)	0 (0.0%)	209 (5.2%)	1,710 (5.6%)
Normal (2500+ grams) (% Liveborn)	12 (100.0%)	109 (100.0%)	3,759 (93.8%)	28,588 (93.1%)
Unknown (% Liveborn)	0 (0.0%)	0 (0.0%)	6 (0.1%)	69 (0.2%)
Number at Birth				
One (singleton) (% Total Births)	12 (100.0%)	109 (100.0%)	3,942 (97.8%)	30,266 (97.8%)
Two (twin) (% Total Births)	0 (0.0%)	0 (0.0%)	88 (2.2%)	654 (2.1%)
Three (triplet) (% Total Births)	0 (0.0%)	0 (0.0%)	0 (0.0%)	18 (0.1%)
Gestational Age				
Extremely immature (<28 weeks) (% Total Births)	0 (0.0%)	0 (0.0%)	23 (0.6%)	267 (0.9%)
Premature (28-36 weeks) (% Total Births)	0 (0.0%)	2 (1.8%)	298 (7.4%)	2,453 (7.9%)
Term/post-term (>36 weeks) (% Total Births)	12 (100.0%)	106 (97.2%)	3,691 (91.6%)	28,218 (91.2%)
Unknown (% Total Births)	0 (0.0%)	1 (0.9%)	18 (0.4%)	0 (0.0%)
Avg Cost of Infant Medical Care				
Mean 1st Year Medicaid Cost	$258	$735	$2,583	$3,068
Median 1st Year Medicaid Cost	$78	$459	$1,208	$1,257

* *Neonatal and post-neonatal death figures are given for January 1989 through December 1992 only. Rates for neonatal and post-neonatal deaths are calculated for live births by category from January 1989 through December 1992: Home =* ***10****, Birth Center =* ***94****, Hospital =* ***2,617****.*

While rates of neonatal and postneonatal mortality (16.8 and 14.4 per 1000, respectively) among the women who received some prenatal care from midwives and delivered in hospital appear to be substantially higher than the rates for Medicaid births in general (4.6 and 5.0 per 1000), it is important to remember that this group selects for high-risk births. The differences in infant mortality rates will be explored in more detail in Part IV.

Births with prenatal care from licensed midwives may also be compared to births with prenatal care from certified nurse midwives. Birth outcomes for this group are shown in Table 5. In contrast to women who received prenatal care from licensed midwives, women with prenatal care from certified nurse midwives delivered primarily in hospital settings. While 43% (811 / 1,881) of births with prenatal care from licensed midwives occurred in hospital, 97% (4,030 / 4,151) of births with prenatal care from certified nurse midwives occurred in hospital.

The hospital births for the certified nurse midwives group demonstrate very low rates of poor birth outcomes — lower rates of fetal, neonatal, and postneonatal mortality, very low and medium low birthweight, and prematurity compared to the general Medicaid births. This pattern is very different from that shown in Table 3 for births with prenatal care from licensed midwives. Both certified nurse midwives and licensed midwives tend to enroll low risk women in their practices: for certified nurse midwives, the hospital is the primary delivery site, while for licensed midwives home births are typically planned, and women who develop complications or new risk factors are referred for hospital delivery. This difference in the pattern of delivery site is reflected in the different birth outcomes for hospital births for women with prenatal care from certified nurse midwives compared to licensed midwives: rates of neonatal and postneonatal deaths, low birth weight, and prematurity were greater than those for the general Medicaid population for hospital births for women with prenatal care from licensed midwives and less than those for the general Medicaid population for hospital births for women with prenatal care from certified nurse midwives.

TABLE 6

CHARACTERISTICS OF WOMEN WITH MEDICAID FUNDED PRENATAL CARE PROVIDED BY LICENSED MIDWIVES

MATERNAL CHARACTERISTIC	PRENATAL CARE PROVIDED BY LICENSED MIDWIFE Births from January 1989 - December 1994						ALL MEDICAID Births: 1992	
	Home (Midwife Attended) (N = 704)		Birth Center (N = 363)		Hospital (N = 789)		(N = 30,601)	
Race / Ethnicity								
White	666	(94.6%)	318	(87.6%)	689	(87.3%)	19,836	(64.8%)
Hispanic	13	(1.8%)	12	(3.3%)	27	(3.4%)	5,336	(17.4%)
African American	5	(0.7%)	7	(1.9%)	12	(1.5%)	1,804	(5.9%)
Native American	11	(1.6%)	8	(2.2%)	16	(2.0%)	1,244	(4.1%)
Asian	7	(1.0%)	15	(4.1%)	14	(1.8%)	1,596	(5.2%)
Unknown	2	(0.3%)	3	(0.8%)	31	(3.9%)	785	(2.6%)
Age								
Less than 15 Years Old	4	(0.6%)	0	(0.0%)	0	(0.0%)	111	(0.4%)
15 - 17 Years Old	17	(2.4%)	12	(3.3%)	36	(4.6%)	2,602	(8.5%)
18 - 19 Years Old	44	(6.3%)	28	(7.7%)	87	(11.0%)	4,228	(13.8%)
20 -24 Years Old	168	(23.9%)	111	(30.6%)	266	(33.7%)	11,708	(38.3%)
25 - 29 Years Old	196	(27.8%)	84	(23.1%)	157	(19.9%)	6,715	(21.9%)
30 - 34 Years Old	158	(22.4%)	85	(23.4%)	161	(20.4%)	3,590	(11.7%)
35 - 39 Years Old	106	(15.1%)	36	(9.9%)	67	(8.5%)	1,338	(4.4%)
Greater than 39 Years Old	11	(1.6%)	7	(1.9%)	13	(1.6%)	279	(0.9%)
Unknown	0	(0.0%)	0	(0.0%)	2	(0.3%)	30	(0.1%)
Average Age (mean)	**27.6**		**26.8**		**25.9**		**24.0**	
Marital Status								
Married	468	(66.5%)	214	(59.0%)	427	(54.1%)	14,712	(48.1%)
Single	235	(33.4%)	149	(41.0%)	355	(45.0%)	15,816	(51.7%)
Unknown	1	(0.1%)	0	(0.0%)	7	(0.9%)	73	(0.2%)
Educational Attainment *								
No Education	0	(0.0%)	0	(0.0%)	0	(0.0%)	151	(0.5%)
Some Elementary (1 - 7 Years)	2	(0.5%)	4	(1.4%)	9	(1.7%)	1,724	(5.6%)
Elementary Grad. (8 - 11 Years)	55	(12.6%)	44	(15.6%)	71	(13.3%)	7,921	(25.9%)
High School Grad. (12 Years)	158	(36.1%)	92	(32.6%)	202	(37.9%)	10,189	(33.3%)
Some College (13 - 15 Years)	120	(27.4%)	84	(29.8%)	120	(22.5%)	4,158	(13.6%)
College Grad. (16 Years)	52	(11.9%)	35	(12.4%)	30	(5.6%)	685	(2.2%)
Some Post - Grad. (17+ Years)	29	(6.6%)	20	(7.1%)	29	(5.4%)	263	(0.9%)
Unknown	22	(5.0%)	3	(1.1%)	72	(13.5%)	5,510	(18.0%)
Smoking History								
Smoker	90	(12.8%)	66	(18.2%)	175	(22.2%)	9,279	(30.3%)
Non-Smoker	608	(86.4%)	296	(81.5%)	516	(65.4%)	20,294	(66.3%)
Unknown	6	(0.9%)	1	(0.3%)	98	(12.4%)	1,028	(3.4%)
Number of Prior Children								
None	213	(30.3%)	169	(46.6%)	392	(49.7%)	12,642	(41.3%)
One	188	(26.7%)	91	(25.1%)	181	(22.9%)	8,449	(27.6%)
Two	132	(18.8%)	48	(13.2%)	109	(13.8%)	4,954	(16.2%)
Three to Five	150	(21.3%)	49	(13.5%)	92	(11.7%)	3,751	(12.3%)
Six or more	20	(2.8%)	6	(1.7%)	6	(0.8%)	455	(1.5%)
Unknown	1	(0.1%)	0	(0.0%)	9	(1.1%)	350	(1.1%)
Medicaid Eligibility								
Grant Recipient (< 60% FPL)	181	(25.7%)	94	(25.9%)	275	(34.9%)	14,230	(46.5%)
Pre-FS Med Only (< 90% FPL)	132	(18.8%)	97	(26.7%)	170	(21.5%)	6,961	(22.7%)
FS Expansion (90 - 185% FPL)	371	(52.7%)	171	(47.1%)	343	(43.5%)	9,161	(29.9%)
Served, No Elig. Record	20	(2.8%)	1	(0.3%)	1	(0.1%)	238	(0.8%)
Eligible, No Service	0	(0.0%)	0	(0.0%)	0	(0.0%)	11	(0.0%)

* *Information about the mother's education level is not available for births before 1992. Percentages are calculated for mothers giving birth in 1992 or later by category: Home = **438**, Birth Center = **282**, Hospital = **533**.*

II. Maternal Characteristics

Pregnant women who are planning home birth and are accepted for prenatal care by a licensed midwife have few medical and social risk factors for poor birth outcomes. This situation probably results from a combination of factors although the most important factor is not known: pregnant women who know that they are low risk may self refer to licensed midwives *or* the midwife may not accept high risk women into prenatal care if they have known contraindications to planned home birth.

As shown in Table 6, women who received some prenatal care from licensed midwives are predominantly white (87 to 95%, compared to 65% of the general Medicaid population), slightly older (average age 25.9 to 27.6 years, compared to 24.0 years of age), mostly married (54 to 66%, compared to 48%), largely non-smokers (smoking rates of 13 to 22%, compared to 30%), and highly educated (at least some college 33.5% to 49.7%, compared to 16.7%).

For women who received some prenatal care from licensed midwives, some characteristics differ between women who had home births and those who gave birth in hospital. The proportion of parous women is higher (70%) among women with home births compared to women with hospital births (50%), and the proportion of multiparous (two or more prior births) women is also higher (42.9%) in the home-birth group compared to the hospital-birth group (26.3%). Women with home births were slightly older (average age 27.6 years) than women who gave birth in hospital (average age 25.9). Nearly half (45.9%) of women in the home-birth group had at least some college education, compared to one-third (33.1%) of women in the hospital-birth group. The rates of smoking (22%) and poverty (indicated by grant recipient status, 35%) were higher among women who had hospital births, compared to women with home births (13% smokers and 26% Grant Recipients).

TABLE 7

AMOUNT AND TIMING OF PRENATAL CARE FOR WOMEN WITH MEDICAID FUNDED PRENATAL CARE PROVIDED BY A LICENSED MIDWIFE

PRENATAL CARE	PRENATAL CARE PROVIDED BY LICENSED MIDWIFE Births from January 1989 - December 1994 Home (Midwife Attended) (N=704)		Birth Center (N=363)		Hospital (N=789)		ALL MEDICAID BIRTHS: 1992 (N=30,601)	
Trimester Prenatal Care Began								
No Prenatal Care	0	(0.0%)	1	(0.3%)	7	(0.9%)	311	(1.0%)
First Trimester	453	(95.3%)	244	(93.1%)	524	(84.8%)	18,949	(87.1%)
Second Trimester	218	(31.0%)	94	(25.9%)	145	(18.4%)	7,723	(25.2%)
Third Trimester	32	(4.5%)	21	(5.8%)	32	(4.1%)	1,885	(6.2%)
Unknown	1	(0.1%)	3	(0.8%)	81	(10.3%)	1,733	(5.7%)
Adequacy of Prenatal Care								
Adequate Plus	97	(13.8%)	102	(28.1%)	168	(21.3%)	5,905	(19.3%)
Adequate	462	(79.4%)	182	(78.2%)	275	(56.2%)	11,309	(56.3%)
Intermediate	91	(12.9%)	26	(7.2%)	121	(15.3%)	6,329	(20.7%)
Inadequate	2	(0.3%)	1	(0.3%)	25	(3.2%)	1,320	(4.3%)
Unknown	52	(7.4%)	52	(14.3%)	200	(25.3%)	5,738	(18.8%)
PNC Included an Initial Assessment (5930 M) Provided By a Licensed Midwife	433	(61.5%)	270	(74.4%)	527	(66.8%)		
Timing of Prenatal Care (PNC) Provided By a Licensed Midwife								
Received Total PNC	230	(32.7%)	325	(89.5%)	158	(20.0%)		
Received 1st, 2nd, and 3rd Trim. PNC	191	(27.1%)	13	(3.6%)	121	(15.3%)		
Received 1st Trim. PNC only	5	(0.7%)	0	(0.0%)	53	(6.7%)		
Received 1st and 2nd Trim. PNC only	7	(1.0%)	4	(1.1%)	72	(9.1%)		
Received 2nd and 3rd Trim. PNC only	164	(23.3%)	5	(1.4%)	143	(18.1%)		
Received 3rd Trim. PNC only	97	(13.8%)	8	(2.2%)	106	(13.4%)		
Received an Initial Assessment of Pregnancy Test only	4	(0.6%)	6	(1.7%)	72	(9.1%)		
Received some other combination of PNC	6	(0.9%)	2	(0.6%)	64	(8.1%)		
Timing of Services Received from a Hospital, Clinic, OB/Gyn, or Radiologist								
Received No Services 2-30 Days before Date of Birth	551	(78.3%)	298	(82.1%)	318	(40.3%)		
Received some Services 2-30 Days before Date of Birth	153	(21.7%)	65	(17.9%)	471	(59.7%)		
2-7 Days	*57*	*(8.1%)*	*33*	*(9.1%)*	*295*	*(37.4%)*		
8-30 Days	*122*	*(17.3%)*	*42*	*(11.6%)*	*372*	*(47.1%)*		

III. Amount and Timing of Prenatal Services

Table 7 describes the amount and timing of prenatal care from birth certificate data for the trimester prenatal care began and the Kotelchuck Index of prenatal care adequacy, in addition to a summary of the prenatal care claims (billings) submitted to Medicaid by licensed midwives.

The rate of first or second trimester initiation of prenatal care was highest in the home birth group (95%). Women with prenatal care from licensed midwives who delivered in birthing centers initiated prenatal care nearly as early, with 93% beginning in the first or second trimester. The rate of first or second trimester initiation for women with prenatal care from licensed midwives with hospital births (85%) was actually slightly lower than that for the general Medicaid population (87%). In addition, 10.3% of women in the hospital birth group had an unknown value for this measure.

Similarly, the proportion of women with adequate or better prenatal care according to the Kotelchuck Adequacy of Prenatal Care Index[10] was substantially higher for the home births and birthing center groups (79.4% and 78.2%, respectively) than for the hospital births and general Medicaid groups (56.2% and 56.3%, respectively). More than one-fourth (25.3%) of the hospital births group had an unknown value for this measure.

The following analyses describing claims for prenatal care provided by licensed midwives were restricted to the three groups with prenatal care provided by licensed midwives. This analysis explores the amount and timing of prenatal care from licensed midwives (and reimbursed by Medicaid) for each of these groups. A majority of women in all three groups received an Initial Assessment provided by a licensed midwife (procedure code 5930M): the proportion receiving Initial Assessments was slightly higher in the hospital-birth group (66.8%) compared to the home-birth group (61.5%). This provides evidence that the proportion of women beginning prenatal care with a licensed midwife was comparable in these two groups. For the birth-center group, the proportion was somewhat higher (74%).

The proportion of women receiving all three trimesters of prenatal care or total prenatal care (billing codes shown on Table 7) from licensed midwives was highest in the birthing center group (93.1%), presumably because midwives performing deliveries at birthing centers could receive reimbursement for delivery services in addition to prenatal care. For the home births group, the proportion was 59.8%, 1.7 times greater than that for the hospital births group (35.3%). This suggests that women in the home births group received considerably more prenatal care from licensed midwives and is consistent with the birth certificate data for initiation and adequacy of prenatal care.

The proportion with only first and second trimester care from licensed midwives was highest in the hospital birth group (9.1%); this is consistent with transfer of care during the third trimester and the rate of preterm delivery in the hospital-birth group since in both of these situations, licensed midwives would not bill for third trimester care. As well, 9.1% of hospital births had only an Initial Assessment or a pregnancy test provided by a licensed midwife.

Another way to use claims data to describe the situation surrounding transfer of care is to look at claims submitted by providers other than licensed midwives during the month prior to delivery. While only about 20% of women in the home-birth and birth-center groups received medical services billed by hospitals, obstetricians, clinics, or radiologists during the 30 days prior to delivery, 60% of women with hospital births received such services, and 47% of this group received these services one to four weeks prior to delivery. On the other hand, 40% of the hospital-birth group received no such services during the month prior to delivery.

IV. Infant Mortality and Major Malformations

As described in Part I, the rates of neonatal and postneonatal mortality among women who received some prenatal care from licensed midwives and gave birth in hospital are higher than the rates for Medicaid births in general. This section will explore this finding in more detail, present results of statistical tests evaluating these differences, and describe the causes of death and underlying medical conditions.

Since women who experience adverse birth outcomes are selectively transferred to the hospital-birth group, infant deaths were analyzed for the group of women receiving some prenatal care from licensed midwives as a whole. Because the matched infant death files are not yet complete for births occurring in 1993 and later, this analysis was limited to births from 1989 through 1992. Also, since the number of events is small (a total of 16 infant deaths among 1,020 liveborn infants born in 1989 through 1992), neonatal and postneonatal mortality were not analyzed separately.

The following table shows that, while the infant mortality rate for births to women who received some prenatal care from licensed midwives (15.7 per 1000) is 1.5 times greater than that for all other Medicaid women who gave birth during the same time period (10.8 per 1000), this difference is not statistically significant (p=0.12). In reviewing the causes of death and underlying medical conditions, it was found that 12 of the 16 infant deaths were attributed either to SIDS (n=6) or to major congenital malformations (or chromosomal abnormalities) (n=6). The SIDS rate for infants born to women with prenatal care from licensed midwives was also greater than that for all other Medicaid births; however, this difference also was not statistically significant (p=0.19). The rate of four major malformations and chromosomal abnormalities found among the infants born to women with prenatal care from licensed midwives (6.9 per 1000) was significantly greater than the rate among all other Medicaid births (1.9 per 1000, p=0.004).

Table 8. Rates of Infant Mortality and Major Malformations: 1989-1992 Births

	Women with Some PNC from Lic. Midwives (N=1020)	All Other Medicaid Women (N=105,317)	p-Value	Risk Ratio (95% Confidence Interval)
Infant Mortality Rate	15.7 per 1000 (n=16)	10.8 per 1000 (n=1124)	p=0.12	1.47 (0.90 to 2.40)
SIDS Rate	5.9 per 1000 (n=6)	3.6 per 1000	p=0.19	1.63 (0.73 to 3.65)
Rate of Major Malformations[2]	6.9 per 1000 (n=7)	1.9 per 1000 (n=198)	p=0.004	3.65 (1.72 to 7.74)

[2] Rates for major malformations (restricted to Down Syndrome, Trisomy 18, diaphragmatic hernia, and conjoined twins) include children who survived the first year of life.

The following table describes the specific malformations and chromosomal abnormalities observed in these groups including both infants who died and those who survived the first year of life.

Table 9. Rates of Specific Malformations: 1989-1992 Births

	Women with Some PNC from Licensed Midwives (N=1020)		All Other Medicaid Women (N=105,317)		Published Studies
	N	Rate per 1000	N	Rate per 1000	Rate per 1000
Down Syndrome	3	2.9	113	1.07	1.17[11]
Trisomy 18	1	1.0	18	0.17	0.15[12]
Diaphragmatic Hernia	1	1.0	61	0.58	0.16-0.33[13, 14]
Conjoined Twins	2	2.0	2	0.019	0.015[15, 16, 17]
Down and/or Trisomy 18	0	0	4	0.04	
TOTAL	**7**	**6.9**	**198**	**1.88**	

Rates from other studies published in the late 1980s and early 1990s provide historical data. The rates for the women who received prenatal care from licensed midwives are considerably above those for both the published studies and the general Medicaid population. A possible explanation for this difference is that women with prenatal care from licensed midwives less frequently decided to terminate pregnancies with birth defects identified by genetic screening. Since the data for these historical studies were collected, rates of birth defects in liveborn infants have decreased considerably as the majority of pregnancies with identified birth defects are terminated in many populations where early genetic screening is routinely performed. However, the rates for Medicaid women in general are quite comparable to the historical rates and demonstrate no reduction in rates which might be attributable to increased frequency of terminations of pregnancies with birth defects. These comparisons suggest that it is unlikely that the observed differences can be attributed to failure to terminate pregnancies with birth defects among women with prenatal care from licensed midwives.

It may be argued that the grouping of these four malformations was arbitrary and driven by the study findings. Other birth defects may exist which have lower frequencies among women with prenatal care from licensed midwives, and such a finding could result in an overall rate of birth defects as low as or lower than that for all other Medicaid women. The purpose of this study was not to describe the frequency of all birth defects, however, and this analysis attempts only to evaluate the likelihood that such a series of malformations would be found by chance in a

population of that size. A different way of describing this likelihood is based on the combined probability (for at least six events) for the individual occurrences of these four birth defects. Such methodology suggests that the occurrence of at least six births affected by such malformations among 1,020 births could be expected by chance alone in 1 of 300 series of births.

While the differences in rates of the individual birth defects appear to be greater among the infants born to women who received prenatal care from licensed midwives compared to all other Medicaid births, the differences are not statistically significant, due to the small numbers involved and the rarity of these events. The occurrence of these birth defects should not be attributed to the prenatal care provided by licensed midwives. All the evidence we have suggests the mothers of these infants were treated appropriately during pregnancy, and the majority (13/16, or 81%, of infants who died during the first year of life) delivered in hospital. However, the occurrence of these birth defects suggests that women who sought prenatal care from licensed midwives may be in some way different from other Medicaid women.

The single most important risk factor associated with Down Syndrome,[18] Trisomy 18[19] and diaphragmatic hernia[20] is advanced maternal age. While women who received prenatal care from licensed midwives were significantly older (average age 26.6 years) than other Medicaid women (average age 23.7 years) ($p=0.0001$), direct adjustment of the rate of Down Syndrome among the Medicaid group did not account for the difference in rates: the age-adjusted rate of Down Syndrome was 1.3 per 1000 for the Medicaid births, still substantially lower than the Down Syndrome rate among births to women with prenatal care from licensed midwives (2.9 per 1000).

Other presumed risk factors for birth defects such as these include family history, previous pregnancy with a birth defect, and exposure to radiation.[21] We have no readily available methods to evaluate the potential contributions of these or other risk factors.

Home birth has previously been identified as a possible risk factor for SIDS.[22] Of the six SIDS cases reported here among women who received prenatal care from licensed midwives, one-half (50%) received a diagnosis of, or treatment for, substance abuse (involving alcohol and/or illicit drugs) during or after their pregnancy.[23] Other research has shown that the SIDS rate in drug-exposed infants is four times greater than that for infants who were not drug-exposed.[24]

Additional data from updates of the DOH Center for Health Statistics Matched Infant Death File for 1994 and 1995 will permit extension of this analysis to 1993 and 1994 births. These new data should be available late in 1996 and will provide an opportunity to see if these results can be replicated.

Discussion

The results of this study are consistent with a large body of literature which has documented the safety of planned home birth for low risk women.[25] In addition, this study has included a significant group of women who present to licensed midwives for pregnancy tests, initial prenatal assessment, and varying amounts of prenatal care and who subsequently deliver in hospital. While most other studies of home births report transfer rates of 6.7%[26] to 27%,[27] we found that 43% of women with some prenatal care from licensed midwives delivered in hospital.

The wide range of transfer rates from published studies of home births is related to the difficulty in precisely identifying the group of women who present to practitioners who perform home deliveries and in obtaining consistent and complete follow-up data on women whose care is transferred. In our study, we have used a very broad definition of women receiving prenatal care from licensed midwives. These women were assumed to be planning (or at least considering) home birth. Some received little prenatal care from licensed midwife (i.e., only a pregnancy test or Initial Assessment), and the transfer rate from this broad group is predictably higher than that for other studies which used a less inclusive definition. While this approach may overestimate adverse outcomes among the hospital births groups, the advantage compared to other published studies is the comprehensiveness of follow-up. Outcomes for all women who planned or considered home birth (indicated by seeking care from licensed midwives) are included.

Acknowledging this and other differences in definitions and methods, it may be of interest to use data compiled from the published studies in the Home Birth Literature Review (1996) performed by the Planned Home Birth and Medicaid Reimbursement Task Force[28] to compare to the outcomes found in this study.

Table 10. Meta-Analysis Results Compared to Washington State Home Births

Birth Outcome	Meta-Analysis of Home Births	Births with PNC Provided by Licensed Midwives 1989-94		All Medicaid
		Home Births (N=706)	Any Delivery Site (N=1,881)	1992 Births (N=30,938)
Fetal Mortality Rate (%)	0.5% (n=19,190)	0	0.9%	0.7%
Low Birth Weight Rate (%)	3.0% (n=88,300)	0.9%	4.2%	6.6%

It is remarkable that outcomes for the home birth group in Washington were considerably better than those computed by meta-analysis for both fetal mortality and low birth weight. For the entire group of births with prenatal care from licensed midwives, low birth weight and fetal mortality were somewhat greater than for the meta-analysis results. At least two explanations may contribute to these differences. First, the selection process used in identifying women who

received some (perhaps only a small amount) of prenatal care from licensed midwives captured a broader group than in the typical published study. Second, the results for Washington are based on the Medicaid population only, and, since birth outcomes are highly associated with socioeconomic level, the rates for these adverse outcomes are higher for the Medicaid population than for Washington State births in general.

It would also have been interesting to compare infant mortality rates in a similar manner; however, the details available in the published studies did not permit a satisfactory analysis for infant mortality. Fetal deaths and low birth weight are the two birth outcome measures with most consistent definitions in the published studies reviewed. Despite this, fetal deaths were not reported by two studies; hence the number of subjects in the study population was relatively low (n=19,190). In addition to definitional issues and inconsistent selection of study subjects, most problematic in the analysis of infant mortality in published reports was the tendency to exclude lethal malformations from further analysis of infant deaths and reported mortality rates.

Conclusion

Birth outcomes for home deliveries were striking for their very low rates of poor outcomes in this study, and, among women who received some prenatal care from licensed midwives, the majority (85% to 100%, depending on the infant's condition) of infants with poor outcomes were transferred for hospital delivery prior to delivery. Women seeking prenatal care from licensed midwives are typically low risk with respect to established risk factors for adverse birth outcomes: they are mostly white, older, married, non-smokers, and highly educated. Many of the same risk factors may predict successful home delivery. Among women seeking prenatal care from licensed midwives, those who were successful in delivering at home tended to be older, even more highly educated, more non-smoking, and financially better off, compared to those who subsequently delivered in hospital. Since higher parity is also strongly associated with home delivery as compared to hospital delivery, this may account for some of the observed relationship with older age, for women become older as they have more children and higher parity was associated with home delivery.

Women who delivered at home and received prenatal care from licensed midwives also demonstrated low risk characteristics regarding their use of prenatal care: they started prenatal care early in their pregnancies and received at least adequate prenatal care according to the Kotelchuck Index. Women in the home births group received considerably more prenatal care from licensed midwives than did women who delivered in hospital. While the same proportion of women in the home births and hospital births groups initiated prenatal care with a licensed midwife (based on receipt of Initial Prenatal Assessment), women in the hospital birth group received less prenatal care from licensed midwives: fewer women entered prenatal care during the first or second trimester; fewer received adequate or better prenatal care; and the proportion who received all three trimesters of care or total care from a licensed midwife was less than two-thirds that for the home births group. Other evidence that women in the hospital births group tended to receive incomplete prenatal care from licensed midwives includes the proportion with only an Initial Assessment or pregnancy test (9.1%) or with billings for only first and second trimesters (9.1%). Sixty percent of women in the hospital births group received services from providers other than licensed midwives during the month prior to delivery, three times the proportion for women in the home birth group.

For the overall group of women identified as receiving some prenatal care from licensed midwives, the infant mortality rate was nearly 1.5 times than for all other Medicaid women although this difference was not statistically significant (that is, 12% of the time, by chance alone, we would expect a difference between the two groups at least as large as that observed). Major malformations and chromosomal abnormalities (Down Syndrome, Trisomy 18, diaphragmatic hernia, and conjoined twins) identified as the causes of death or underlying medical condition in the cases of infant mortality occurred with a significantly increased frequency ($p=0.004$), which was not explained by the older age of the women with prenatal care from licensed midwives. In addition, analysis of SIDS cases revealed 50% of the mothers had a history, or subsequent diagnosis, of substance abuse.

In summary, Medicaid women who seek prenatal care from licensed midwives may not be representative of the general Medicaid population: most of these women are low risk and those who enrolled in prenatal care with licensed midwives are likely to receive early and adequate prenatal care and deliver successfully at home. The higher risk women among those who begin prenatal care (or receive an initial assessment or pregnancy test) with a licensed midwife more frequently deliver in hospital. For these women, follow-up after referral and outreach may be important issues.

For all women seeking prenatal care, including those who may be perceived as low risk as they seek prenatal care from licensed midwives, screening for substance abuse (by history, standardized questionnaire, laboratory testing, or a combination of methods) should be routinely performed and repeated in cases with high suspicion.

Infants of women who seek home birth in a natural setting, with minimal high-tech interventions, are by no means immune from birth defects and chromosomal abnormalities. Because of their older age and other possible risk factors as yet unidentified, these women may be at added risk for such problems, and they should be rigorously counseled and screened for fetal abnormalities. It is to be expected that women who are planning (or considering) home births and seek prenatal care from a licensed midwife may be reluctant to comply with the usual guidelines for procedures such as triple screening (maternal serum alpha-fetoprotein, estriol, and human chorionic gonadotropin) and/or amniocentesis.[29] If the results of this study are replicated and then disseminated, they may prove useful in convincing women considering home birth to undergo at least the standard procedures used in screening for fetal abnormalities.

The finding of higher rates of certain birth defects among women who planned home birth and received prenatal care from licensed midwives is intriguing and could be a random event. The occurrence of these birth defects should not be attributed to the place of birth or the prenatal care provided by licensed midwives. In view of these considerations, the results of this study are consistent with a large body of literature which has documented the safety of planned home birth for low risk women when attended by a trained provider.

ENDNOTES

[1] Cawthon L. *First Steps Database: Speciality of Prenatal Care Providers II.* Washington State Department of Social and Health Services, Office of Research and Data Analysis 3(2), 1992.

[2] Cawthon L. Letter to Leslie Schear dated April 18, 1995.

[3] Bidgood-Wilson M, Barickman C, Ackley S. Nurse-midwifery today. A Legislative Update, Part 1. *Journal of Nurse-Midwifery* 37: 175-209, 1992.

[4] Washington State Department of Social and Health Services, Medical Assistance Administration. *Planned Home Births and Medicaid Reimbursement*, 1992.

[5] Cawthon L, Kenny F, Schrager L. *The First Steps Expansion Group, A Study of Women Newly Eligible for Medicaid Through Expanded Eligibility*, Olympia, Washington: Department of Social and Health Services (Report #7-67a), 1992.

[6] Burnett CA, Jones JA, Rooks J, Chen CH, Tyler CW, Miller A. Home Delivery and Neonatal Mortality in North Carolina. *Journal of the American Medical Association* 244(24): 2741-2745, 1980.

[7] Hinds MW, Bergeisen GH, Allen DT. Neonatal Outcome in Planned Vs. Unplanned Out-of-Hospital Births in Kentucky. *Journal of the American Medical Association* 253: 1578-1582, 1985.

[8] SAS Institute Inc. *SAS/STAT User's Guide Version 6, Fourth Edition.* Cary, North Carolina: SAS Institute Inc., 1989.

[9] Dean AG, Dean JA, Burton AH, Dicker RC. EPI INFO, Version 5.01b: A word-processing, database, and statistics program for epidemiology on microcomputers. USD, Inc., Stone Mountain, Georgia, 1991.

[10] Kotelchuck M. An Evaluation of the Kessner Adequacy of Prenatal Care Index and A Proposed Adequacy of Prenatal Care Utilization Index. *American Journal of Public Health.* 84(9): 1414-1420, 1994.

[11] Centers for Disease Control: *Congenital Malformations Surveillance Report.* January 1982 - December 1985, Issued March 1988.

[12] Goldstein H, Neilsen KG. Rates and Survival of Individuals with Trisomy 13 and 18. Data from a 10-year Period in Denmark. *Clinical Genetics* 34(6): 366-372, 1988.

[13] Yang P, Khoury MJ, Stewart WF, Beath TH, Chee E, Beatty JC, Diamond EL, Gordis L. Comparative Epidemiology of Selected Midline Congenital Abnormalities. *Genetic Epidemiology* 11(2): 141-154, 1994.

[14] Torfs CP, Curry CJ, Bateson TF, Honore LH. A Population-based Study of Congenital Diaphragmatic Hernia. *Teratology* 46(6): 555-565, 1992.

[15] Wittich AC. Conjoined Twins: Report of a Case and Review of the Literature. *Journal of the American Osteopathic Association* 89(9): 1175-1179, 1989.

[16] Metneki J, Ceizel A. Conjoined Twins in Hungary, 1970-1986. *Acta Geneticae Medicae et Gemellologiae* 38(3-4): 285-299, 1989.

[17] Castilla EE, Lopez-Camelo JS, Orioli IM, Paz JE, Sanchez O. The Epidemiology of Conjoined Twins in Latin America. *Acta Geneticae Medicae et Gemellologiae* 37(2): 111-118, 1988.

[18] Huether CA, Gummere GR, Hook EB, Dignan PS, Volodkevich H, Barg M, Ludwig DA, Lamson SH. Down's Syndrome: Percentage Reporting on Birth Certificates and Single year Maternal Age Risk Rates for Ohio 1970-79: Comparison with Upstate New York Data. *American Journal of Public Health* 71(12): 1367-1372, 1981.

[19] Fineman, MD, PhD, R. Personal Communication, June 4, 1996.

[20] Torfs (1992), *ibid.*

[21] Fineman, MD, PhD, R. Personal Communication, June 4, 1996.

[22] Crotty M, Ramsey AT, Smart R, Chan A. Planned Homebirths in South Australia 1976-1987. *Med J Aust* 153: 664-671, 1990.

[23] See Nordlund DJ, Keenan T, Anderson A, Cawthon L. *First Steps PLUS: Yakima First Steps Mobilization Project for Pregnant Substance Abusers* (Olympia, Washington: Department of Social and Health Services, Report #7-71a, 1996) Appendix B for a discussion of methods for identification of substance abusers in the First Steps Database.

[24] Kandall SR, Gaines J, Habel L, Davidson G, Jessop D. Relationship of Maternal Substance Abuse to Subsequent Sudden Infant Death Syndrome in Offspring. *Journal of Pediatrics* 123(1): 120-126, 1993.

[25] Albers L, Katz VL. Birth Setting for Low-Risk Pregnancies, An Analysis of the Current Literature. *Journal of Nurse-Midwifery* 36(4): 215-220, 1991.

[26] Anderson R, Greener D. A Descriptive Analysis of Home Births Attended by CNMs in Two Nurse-Midwifery Services. *Journal of Nurse-Midwifery* 36(2): 95-103, 1991.

[27] Woodcock HC, Read AW, Bower C, Stanley FJ, Moore DJ. A Matched Cohort Study of Planned Home and Hospital Births in Western Australia 1981-1987. *Midwifery* 10: 125-135, 1994.

[28] Washington State Department of Social and Health Services, Medical Assistance Administration, *Home Birth Literature Review*, 1996.

[29] The Content of Obstetrical Care Project of the University of Washington Department of Family Medicine has studied prenatal care provided by certified nurse midwives, family physicians, and obstetrician-gynecologists. Although licensed midwives were not studied in their project, they found that the patients of certified nurse midwives were most likely to be offered the maternal serum alpha-fetoprotein test. However, the patients of certified nurse midwives were most likely to decline the test (Laura-Mae Baldwin, M.D., M.P.H., personal communication, June 26, 1996). Similar trends may occur in the practices of licensed midwives.

BIBLIOGRAPHY

Albers L, Katz VL. Birth Setting for Low-Risk Pregnancies, An Analysis of the Current Literature. *Journal of Nurse-Midwifery* 36(4): 215-220, 1991.

Anderson R, Greener D. A Descriptive Analysis of Home Births Attended by CNMs in Two Nurse-Midwifery Services. *Journal of Nurse-Midwifery* 36(2): 95-103, 1991.

Baldwin L-M, MD, MPH. Personal Communication, June 26, 1996.

Bidgood-Wilson M, Barickman C, Ackley S. Nurse-midwifery today. A Legislative Update, Part 1. *Journal of Nurse-Midwifery* 37: 175-209, 1992.

Burnett CA, Jones JA, Rooks J, Chen CH, Tyler CW, Miller A. Home Delivery and Neonatal Mortality in North Carolina. *Journal of the American Medical Association* 244(24): 2741-2745, 1980.

Castilla EE, Lopez-Camelo JS, Orioli IM, Paz JE, Sanchez O. The Epidemiology of Conjoined Twins in Latin America. *Acta Geneticae Medicae et Gemellologiae* 37(2): 111-118, 1988.

Cawthon L, Kenny F, Schrager L. *The First Steps Expansion Group: A Study of Women Newly Eligible for Medicaid Through Expanded Eligibility.* Olympia, Washington: Department of Social and Health Services (Report #7-67a), 1992.

Cawthon L. *First Steps Database: Speciality of Prenatal Care Providers II.* Washington State Department of Social and Health Services, Office of Research and Data Analysis 3(2), 1992.

Cawthon L. Letter to Leslie Schear dated April 18, 1995.

Centers for Disease Control. *Congenital Malformations Surveillance Report.* January 1982 - December 1985, Issued March 1988.

Crotty M, Ramsey AT, Smart R, Chan A. Planned Homebirths in South Australia 1976-1987. *Med J Aust* 153: 664-671, 1990.

Dean AG, Dean JA, Burton AH, Dicker RC. EPI INFO, Version 5.01b: A word-processing, database, and statistics program for epidemiology on microcomputers. USD, Inc., Stone Mountain, Georgia, 1991.

Fineman R, MD, PhD. Personal Communication, June 4, 1996.

Goldstein H, Neilsen KG. Rates and Survival of Individuals with Trisomy 13 and 18. Data from a 10-year Period in Denmark. *Clinical Genetics* 34(6): 366-372, 1988.

Hinds MW, Bergeisen GH, Allen DT. Neonatal Outcome in Planned Vs. Unplanned Out-of-Hospital Births in Kentucky. *Journal of the American Medical Association* 253: 1578-1582, 1985.

Huether CA, Gummere GR, Hook EB, Dignan PS, Volodkevich H, Barg M, Ludwig DA, Lamson SH. Down's Syndrome: Percentage Reporting on Birth Certificates and Single year Maternal Age Risk Rates for Ohio 1970-79: Comparison with Upstate New York Data. *American Journal of Public Health* 71(12): 1367-1372, 1981.

Kandall SR, Gaines J, Habel L, Davidson G, Jessop D. Relationship of Maternal Substance Abuse to Subsequent Sudden Infant Death Syndrome in Offspring. *Journal of Pediatrics* 123(1): 120-126, 1993.

Kotelchuck M. An Evaluation of the Kessner Adequacy of Prenatal Care Index and A Proposed Adequacy of Prenatal Care Utilization Index. *American Journal of Public Health* 84(9): 1414-1420, 1994.

Metneki J, Ceizel A. Conjoined Twins in Hungary, 1970-1986. *Acta Geneticae Medicae et Gemellologiae* 38(3-4): 285-299, 1989.

Nordlund DJ, Keenan T, Anderson A, Cawthon L. *First Steps PLUS*: *Yakima First Steps Mobilization Project for Pregnant Substance Abusers.* Olympia, Washington: Department of Social and Health Services (Report #7-71a), 1996.

SAS Institute Inc. *SAS/STAT User's Guide Version 6, Fourth Edition.* Cary, North Carolina: SAS Institute Inc., 1989.

Torfs CP, Curry CJ, Bateson TF, Honore LH. A Population-based Study of Congenital Diaphragmatic Hernia. *Teratology* 46(6): 555-565, 1992.

Washington State Department of Social and Health Services, Medical Assistance Administration. *Home Birth Literature Review*, 1996.

Washington State Department of Social and Health Services, Medical Assistance Administration. *Planned Home Births and Medicaid Reimbursement*, 1992.

Wittich AC. Conjoined Twins: Report of a Case and Review of the Literature. *Journal of the American Osteopathic Association* 89(9): 1175-1179, 1989.

Woodcock HC, Read AW, Bower C, Stanley FJ, Moore DJ. A Matched Cohort Study of Planned Home and Hospital Births in Western Australia 1981-1987. *Midwifery* 10: 125-135, 1994.

Yang P, Khoury MJ, Stewart WF, Beath TH, Chee E, Beatty JC, Diamond EL, Gordis L. Comparative Epidemiology of Selected Midline Congenital Abnormalities. *Genetic Epidemiology*. 11(2): 141-154, 1994.