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# Vital Records Evaluation Using 1988 National Maternal and Infant Health Survey Data

## Executive Summary

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Submitted to:

National Center for Health Statistics  
Centers for Disease Control  
6525 Belcrest Road  
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## EXECUTIVE SUMMARY

### I. Statement of the Problem

The National Maternal and Infant Health Survey (NMIHS), conducted in 1989, is a potentially rich source of data concerning births, fetal deaths, and infant deaths that took place in the United States in 1988. It is based on a nationwide probability sample, covering roughly 10,000 live births, 4,000 fetal deaths, and 6,000 infant deaths, in which low birth-weight infants and black births and fetal deaths were oversampled.

The present study focuses on the live birth and fetal death aspects of the NMIHS. The study is directed toward evaluating the vital records (live birth certificates and fetal death reports) prepared in 1988 covering the same events included in the NMIHS sample. The rationale underlying the evaluation is as follows: to the extent that these sources agree, they reinforce each other's **credibility**; to the extent that they differ, problems which may require corrective action (or at least caution on the part of researchers) are identified.

### II. Evaluation Objectives

The study consists of four components:

- o Component 1 ("**Checkbox** Items") addresses a series of questions, added to the vital record by some states in 1988, concerning maternal risk factors, obstetric procedures, and other items of a similar nature. These questions are couched in a **checkbox** format similar or identical to that implemented in the 1989 U.S. Standard Certificate of Live Birth and Standard Report of Fetal Death. The objective in this portion of the study **was two-fold:** (a) assess the quality and

completeness with which these new items were reported, and (b) explore discrepancies between selected items (primarily mother's alcohol use, tobacco use, and weight gain during pregnancy) and comparable elements in the NMIHS. Because 1988 was a learning experience for the states involved, no explicit assessment of individual state performance was performed.

- o Component 2 ("Underlying Cause of Fetal Death") also consists of two parts. In the first part, the contractor reviewed the cause-of-death sections of some 4,500 fetal death reports for the purpose of determining, if possible, the underlying cause of death and assigning it the appropriate ICD-9 code. The second part consisted of an assessment of the quality and completeness of the information on which the first part was based, i.e., the cause or causes of death entered in the vital record by the person responsible for its preparation.
- o Component 3 ("Industry and **Occupation**") addresses the industry and occupation of both mother and father as reported in the vital record. The objectives of this component paralleled those of Component 1, namely: (a) assess the quality and completeness of parents' industry and occupation as reported in the vital record, and (b) explore discrepancies between these variables and the identical elements in the NMIHS.
- o Component 4 ("Multiple Causes of **Death**") is an extension of Component 2, added through contract modification. It called for the contractor to code all listed causes of fetal death, not just the cause deemed to be underlying. Other objectives of this component were to (a) obtain a clearer picture of the order in which the immediate (first-listed) and underlying (**second-** and third-listed) causes of death are listed in the vital record, and (b) study the connection between the information that appears in the **checkbox** and cause-of-death sections respectively.

### III. Methodology

The data used to perform this study were drawn from two basic sources:

- a. States. - Each of the states that participated in the study submitted a photocopy of the original vital record for each mother identified as having been included in the 1988 NMIHS sample. In all, over 3,200 live birth certificates and over 4,500 fetal death reports were received.
  
- b. NCHS. - The National Center for Health Statistics furnished the contractor with two separate files: a mother's file and a hospital/provider file. The mother's file consisted of a set of computer tapes in which were stored the responses furnished by the mothers in the NMIHS sample to a 35-page survey instrument with section headings as follows:

- Part A - Prenatal Care and Health Habits
- Part B - Delivery of Your Baby
- Part C - Other Pregnancies
- Part D - Mother's Characteristics
- Part E - Father's Characteristics
- Part F - Family Income

The hospital/provider (H/P) file, a second set of computer tapes, contained a series of additional data elements, primarily clinical in nature, concerning the mother, infant, and/or fetus. These items were reported by up to seven prenatal care providers and by the hospital (or hospitals) responsible for delivery and/or postnatal care, in response to questionnaires of somewhat substantial length (16 pages for prenatal care providers, 32 pages for hospitals).

The manner in which these data elements were processed and analyzed varied by component:

Component 1 (Checkbox Items). - This component consisted of two parts. The first addressed the quality and completeness of the vital record in and of itself. The second addressed discrepancies between the vital record and the NMIHS.

a. The quality and completeness of the vital record was measured by two indices:

(1) The frequency with which entire **checkbox** sections were omitted, i.e., nothing was checked, not even **"None"**.

(2) The frequency with which positive entries were made, i.e., boxes other than **"None"** were checked.

Variations in these frequencies between states, between sections of the vital record, and particularly between live birth certificates and fetal death reports, were explored for signs of consistency and reasonableness. Other comparisons, involving demographic and/or socioeconomic characteristics, were deemed to be of specious value.

b. Discrepancies between the vital record and the NMIHS mother's file were explored through a series of tabulations involving both the linked and unlinked data. Unlinked tabulations, both vital record and NMIHS, were examined to obtain a basic **"feel"** for the nature of the data. These were then supplemented by tabulations involving linked vital record and NMIHS data, matched by ID number. The linked tabulations consisted primarily of matrices showing the joint distribution of replies, one source versus the other. The variables studied, by decision of the project advisory panel, were mother's alcohol use, tobacco use, and weight gain during pregnancy.

Because an appreciable percentage of the stored "responses" in the mother's file concerning weight prior to pregnancy and prior to delivery was imputed, the associated weight gain distributions were divided into two parts: those in which the mother's response was imputed and those in which it was not. Differences between the imputed and non-imputed distributions were explored.

The final stage of this evaluation consisted of a three-way comparison of values reported in the vital record, NMIHS mother's file, and NMIHS H/P file, linked by ID number. The comparisons were performed on the coded data and took the form of dividing the linked records into three categories: those in which all three sources agreed, those in which all three sources disagreed, and those in which two sources agreed and the third did not. The latter category was in turn subdivided into three subcategories depending on which data source was the outlier.'

**Component 2 (Underlyina Cause of Death).** - After all fetal death reports were coded for underlying cause, tabulations were performed of the percentage of times in which no definitive cause could be determined. These indeterminate cases were divided into three categories:

- a. No cause was listed in the fetal death report.
- b. The cause (or causes) were stated to be "unknown".
- c. The terminology employed by the person preparing the report was vague or uninformative (e.g., "fetal demise", "still birth", etc.).

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<sup>1</sup> A fourth variable, method of delivery, was added in this portion of the study. Because this variable did not appear in the mother's file, however, only a two-way comparison -- between the vital record and the H/P file -- was performed.

Variations in these indeterminacy rates, taken to be a measure of quality and completeness, were explored from state to state, both overall and in terms of the foregoing three-way split.

Component 3 (Industry and Occupation). - The approach adopted in this component paralleled that employed in Component 1. Initially, the vital record was evaluated unto itself by assessing the percentage of times (a) no information was reported on industry and occupation or (b) the information reported was too vague or non-specific to be coded (using the Industrial Classification and Occupational Classification Systems developed by the Bureau of the Census, conventionally employed by NCHS).

Variations in omission and/or indeterminacy rates were explored between mother and father, between industry and occupation, between live births and fetal deaths, and between states that had been reporting industry and occupation prior to 1988 and those that started that year.

The second part of this investigation took the form of examining the linked records, matched by ID number. Since industry and occupation were not reported in the H/P file, the comparisons were two-way in nature -- vital record versus mother's file.

Component 4 (Multiple Causes of Death). - This final component of the study consisted largely of two special exercises: (a) an examination of the joint distribution of first- and second-listed (and in some cases, third-listed) causes of death, and (b) an assessment of the degree of correspondence between information reported in the **checkbox** and cause-of-death sections of the fetal death report. The latter investigation took the form of noting the percentage of times a given medical condition was listed as a cause of death but not reported in the **checkbox** section and vice versa. Variations from state to state were, to a limited extent, performed.

#### IV. Major Findings and Recommendations

##### Component 1 (Checkbox Items)

1. In the case of live birth certificates, the frequency with which entire **checkbox** sections were omitted (i.e., no entry was made at all) was, in this first year of **checkbox** implementation, gratifyingly small -- two percent or less. For fetal death reports, the omission rate was substantially higher, commonly in two digits. [**Page 12**]<sup>2</sup>
2. The frequency with which positive entries were made in each of the various **checkbox** sections of the vital record seemed reasonable. While differences were noted between live births and fetal deaths, the observed differences made medical sense. [**Page 13**]
3. For the variable "**alcohol use**", little difference was seen between the values reported in the vital record and those reported in the mother's file, except for extremely low values of consumption which sometimes tended to go unreported in the vital record. [**Pages 14 and 20**]
4. For the variable "**tobacco use**", there can be substantial differences between the two data sources, with the NMIHS value commonly running higher. [**Pages 16 and 21**]
5. For the variable "**weight gain**", differences between the vital record and mother's file can be quite large. To some extent, this is due to the fact that weight gain is not explicitly reported by the mother but is rather calculated as the difference between her reported pregravid and predelivery

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<sup>2</sup> References in bold denote the page number of the **JWK** final report on which the finding in question may be found.

9. For the variable "**method** of delivery", the discrepancy rate between the vital record and H/P file depends on the type of delivery. Vaginal births were characterized by a low discrepancy rate (roughly 2%), primary and repeat C-sections were discrepant about 10% of the time, and all other methods of delivery were discrepant quite often. [Page 38]

### Component 2 (Underlying Cause of Fetal Death)

1. The underlying cause of fetal death was indeterminate in roughly one-third of all cases. This was only rarely due to the fact that no cause had been entered: more commonly, it was due to the fact that the person preparing the report declared the cause to be unknown or expressed the cause in vague or uninformative terms (e.g., "**fetal demise**"). [Page 553]
2. **Substantial** variations in the frequency of indeterminate cases were noted from state to state. [Page 56]

These variations, it is believed, speak more to differences among reporting personnel and/or reporting policy than to differences in the types of fetal death. No analysis was performed, however, to support this conjecture.

RECOMMENDATION: Given the wide variations noted, further study of this issue to determine the reasons **therefor** may be warranted.

### Component 3 (Industry and Occupation)

1. Information on mother's industry and occupation was more commonly and fully reported than **that on fathers**. [Page 403]
2. Information on occupation, both mother's and father's, was more commonly and fully reported than **that on industry**. [Ibid]

3. There is no evidence that industry and occupation were more commonly or fully reported in the case of live births than fetal deaths, or vice versa. [Ibid]
4. For mother's occupation and for father's industry and occupation, there is evidence that states that reported this information in years prior to 1988 did somewhat better, in terms of completeness of reporting, than those that started in that year. [Page 41]
5. The observed match rate between the vital record and the NMIHS mother's file was roughly one-third. No essential differences were noted between mothers and fathers, or between industry and occupation. [Page 47]
6. The match rates varied, as one might expect, by industry and occupation:
  - o Among industries, for both mother and father, "finance, insurance, and real estate", **"professional and related services"**, and **"armed forces"** had higher-than-average match rates. The match rates for **"wholesale trade"**, "business and repair services", "personal services", and "entertainment and recreation services" tended to be low. [Pages 43 and 44]
  - o Among occupations, "professional specialties" and "military" ranked high in terms of match rate for both mothers and fathers; "handlers, equipment cleaners, helpers, and laborers" ranked low. Some occupations (**"protective service"**, "farming, forestry, and fishing", and **"precision production, craft, and repair"**) ranked significantly higher for fathers than mothers. [Pages 45 and 46]

7. The most common reason for mismatch in the case of mothers was the absence of an explicit category for "homemakers".<sup>2</sup> [Page 48]

RECOMMENDATION: Consideration should be given to the incorporation of such a category in future versions of the NMIHS.

- a. The most common reason for mismatch in the case of fathers was the absence in the vital record of a suitable, **codable** entry. The lack of such an entry accounted for 43% of the mismatches involving father's industry and 36% of those involving occupation. [Ibid]
9. As in the case of weight gain, imputation is an important factor in creating apparent discrepancies. Where either industry or occupation was imputed in the mother's file, the match rate declined precipitously. [Pages 49 and 503]

RECOMMENDATION: See prior recommendation concerning the importance of alerting researchers to the existence of imputation flags when dealing with records on a case-by-case basis.

#### Component 4 (Multiple Causes of Death)

1. The single most common combination of causes of fetal death involved ICD-9 code 768.X ("hypoxia/asphyxia") as the **first**-listed cause and 762.X ("**complications** of cord, placenta, and membranes") as the second. [Page 59]

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<sup>2</sup> The NMIHS questionnaire includes no provisions for identifying homemakers. If the mother didn't work during the twelve months prior to delivery, she was instructed to "describe the last job you held before this pregnancy."

2. The next most common combination involved the following sequence: a non-specific cause (such as **"fetal demise"**) listed first, followed by a statement that the underlying cause was **"unknown"**. [Ibid]
3. The third most common combination involved a non-specific cause **followed by** an explicit reference to complications of the cord, placenta, or membranes, **codable** to 762.X. [Ibid]
4. Among those causes most commonly reported, the order in which they were listed seems to be generally correct. Immediate causes (e.g., hypoxia/anoxia) were more commonly listed first; underlying causes (e.g., cord accidents) were more commonly listed second (or third). [Page 60]
5. The term **"unknown"** was more commonly used to describe the underlying cause than the immediate (first-listed) cause. Vague or uninformative terms were more commonly used to describe the immediate cause than **the** underlying cause. [Ibid]
6. A substantial percentage of cases was observed in which the cause of death listed in the fetal death report, although reportable as a data element in the **checkbox** section as well, went unreported in that section. The percentage of cases in which items of this nature were reported in **both** locations ranged, generally, between 30 and 50 percent, with a low of 18% for eclampsia. [Page 62]

RECOMMENDATION: Researchers who deal with the **checkbox** findings of vital records should be cautioned that in 1988 -- the first year of **checkbox** implementation -- some degree of underreporting, of at least some data elements, appears to have taken place.

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An advisory committee was appointed to provide assistance in the design, analysis, and interpretation of the evaluation. The members were: Delton Atkinson, Director of the North Carolina State Center for Health and Environmental Statistics (represented the Association for Vital Records and Health Statistics); Robert Heuser, Chief of the Natality, Marriage, and Divorce Statistics Branch, DVS, NCHS; George Gay, Chief of the Registration Methods Branch, DVS, NCHS; and Harry Rosenberg, Ph.D., Chief of the Mortality Statistics Branch, DVS, NCHS. **Marian MacDorman**, Ph.D., Statistician in the Mortality Statistics Branch, also participated in meetings of the advisory committee.

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## 1. INTRODUCTION

### 1.1 Purpose of Study

The purpose of this study is to compare selected data elements reported in the 1988 National Maternal and Infant Health Survey (NMIHS) with comparable information contained in the original vital records, maintained by the states, covering the same set of birth events and/or fetal deaths. To the extent practicable, the quality and completeness of the information reported in the vital record is to be assessed, discrepancies with **respect to** the NMIHS identified, and the nature and frequency of the discrepancies examined.

The study universe consists of 43 jurisdictions (42 states plus New York City) that met certain conditions for participation and agreed to participate. Each jurisdiction submitted copies of the live birth certificates and/or fetal **death** reports in its possession covering the specific mothers included in the 1988 NMIHS sample. The records were then made available to JWK International Corporation, under a non-disclosure agreement, for coding, creation of data files, and analysis against the NMIHS tapes.

### 1.2 D e f i n i t i o n s

There are four components to the study. As defined by contract, they are:

- Component 1 - **Checkbox** items
- Component 2 - Underlying cause of fetal death
- Component 3 - Industry and occupation
- Component 4 - Multiple causes of death

The nature and purpose of each are described below.

0 Component 1 (Checkbox Items)

The purpose of this component is to "determine whether data collected for new items on birth certificates and reports of fetal death are complete and accurate, and identify the characteristics of the types of cases where misreporting is greatest."

The "new items" in question are a series of checkboxes, formatted as shown in Exhibit 1, dealing with such topics as maternal risk factors, complications of labor and/or delivery, etc. These items were added to the U.S. Standard Certificate of Live Birth and Report of Fetal Death in 1989 but were adopted by some states the year before, i.e., the year of the NMIHS. Only states that implemented the new format, or a modified version thereof, in 1988 are included in this portion of the study. The states in question and the number of records submitted by each are as follows:

	Number of Vital Records Received from States That Implemented the Checkbox Format in 1988			
	<u>Live Birth</u>		<u>Fetal Death</u>	
	<u>Standard Format</u>	<u>Modified Format</u>	<u>Standard Format</u>	<u>Modified Format</u>
Alabama	280		132	
Connecticut		21		19
Georgia		564		
Hawaii	34			
Indiana	112		114	
Kansas				26
Kentucky	144			
Maine	30			15
Nevada	56			
New Hampshire			28	
New Mexico				21
New York		439		
New York City		727		317
North Carolina	417		140	
Washington		146		
Totals	<u>1,073</u>	<u>1,897</u>	414	398

Since 1988 was in effect a learning experience for these states, no attempt was made to assess and compare the relative performance of

## EXHIBIT 1. STANDARD CHECKBOX FORMAT

<p><b>38a. MEDICAL RISK FACTORS FOR THIS PREGNANCY</b> <i>(Check all that apply)</i></p> <p>Anemia (Hct. &lt; 30/Hgb. &lt; 10) ..... 01 <input type="checkbox"/></p> <p>Cardiac disease ..... 02 <input type="checkbox"/></p> <p>Acute or chronic lung disease ..... 03 <input type="checkbox"/></p> <p>Diabetes ..... 04 <input type="checkbox"/></p> <p>Genital herpes ..... 05 <input type="checkbox"/></p> <p>Hydramnios/Oligohydramnios ..... 06 <input type="checkbox"/></p> <p>Hemoglobinopathy ..... 07 <input type="checkbox"/></p> <p>Hypertension, chronic ..... 08 <input type="checkbox"/></p> <p>Hypertension, pregnancy-associated ..... 09 <input type="checkbox"/></p> <p>Eclampsia ..... 10 <input type="checkbox"/></p> <p>Incompetent cervix ..... 11 <input type="checkbox"/></p> <p>Previous infant 4000+ grams ..... 12 <input type="checkbox"/></p> <p>Previous preterm or small-for-gestational-age infant ..... 13 <input type="checkbox"/></p> <p>Renal disease ..... 14 <input type="checkbox"/></p> <p>Rh sensitization ..... 15 <input type="checkbox"/></p> <p>Uterine bleeding ..... 16 <input type="checkbox"/></p> <p>None ..... 00 <input type="checkbox"/></p> <p>Other ..... 17 <input type="checkbox"/></p> <p style="text-align: center;"><i>(Specify)</i></p>	<p><b>40. COMPLICATIONS OF LABOR AND/OR DELIVERY</b> <i>(Check all that apply)</i></p> <p>Febrile (&gt; 100°F. or 38°C.) ..... 01 <input type="checkbox"/></p> <p>Meconium, moderate/heavy ..... 02 <input type="checkbox"/></p> <p>Premature rupture of membrane (&gt;12 hours) ..... 03 <input type="checkbox"/></p> <p>Abruptio placenta ..... 04 <input type="checkbox"/></p> <p>Placenta previa ..... 05 <input type="checkbox"/></p> <p>Other excessive bleeding ..... 06 <input type="checkbox"/></p> <p>Seizures during labor ..... 07 <input type="checkbox"/></p> <p>Precipitous labor (&lt; 3 hours) ..... 08 <input type="checkbox"/></p> <p>Prolonged labor (&gt;20 hours) ..... 09 <input type="checkbox"/></p> <p>Dysfunctional labor ..... 10 <input type="checkbox"/></p> <p>Breech/Malpresentation ..... 11 <input type="checkbox"/></p> <p>Cephalopelvic disproportion ..... 12 <input type="checkbox"/></p> <p>Cord prolapse ..... 13 <input type="checkbox"/></p> <p>Anesthetic complications ..... 14 <input type="checkbox"/></p> <p>Fetal distress ..... 15 <input type="checkbox"/></p> <p>None ..... 00 <input type="checkbox"/></p> <p>Other ..... 16 <input type="checkbox"/></p> <p style="text-align: center;"><i>(Specify)</i></p>	<p><b>43. CONGENITAL ANOMALIES OF CHILD</b> <i>(Check all that apply)</i></p> <p>Anencephalus ..... 01 <input type="checkbox"/></p> <p>Spina bifida/Meningocele ..... 02 <input type="checkbox"/></p> <p>Hydrocephalus ..... 03 <input type="checkbox"/></p> <p>Microcephalus ..... 04 <input type="checkbox"/></p> <p>Other central nervous system anomalies <i>(Specify)</i> ..... 05 <input type="checkbox"/></p> <p>Heart malformations ..... 06 <input type="checkbox"/></p> <p>Other circulatory/respiratory anomalies <i>(Specify)</i> ..... 07 <input type="checkbox"/></p> <p>Rectal atresia/stenosis ..... 08 <input type="checkbox"/></p> <p>Tracheo esophageal fistula/Esophageal atresia ..... 09 <input type="checkbox"/></p> <p>Omphalocele/ Gastroschisis ..... 10 <input type="checkbox"/></p> <p>Other gastrointestinal anomalies <i>(Specify)</i> ..... 11 <input type="checkbox"/></p> <p>Malformed genitalia ..... 12 <input type="checkbox"/></p> <p>Renal agenesis ..... 13 <input type="checkbox"/></p> <p>Other urogenital anomalies <i>(Specify)</i> ..... 14 <input type="checkbox"/></p> <p>Cleft lip/palate ..... 15 <input type="checkbox"/></p> <p>Polydactyly/Syndactyly/Adactyly ..... 16 <input type="checkbox"/></p> <p>Club foot ..... 17 <input type="checkbox"/></p> <p>Diaphragmatic hernia ..... 18 <input type="checkbox"/></p> <p>Other musculoskeletal/integumenta anomalies <i>(Specify)</i> ..... 19 <input type="checkbox"/></p> <p>Down's syndrome ..... 20 <input type="checkbox"/></p> <p>Other chromosomal anomalies <i>(Specify)</i> ..... 21 <input type="checkbox"/></p> <p>None ..... 00 <input type="checkbox"/></p> <p>Other ..... 22 <input type="checkbox"/></p> <p style="text-align: center;"><i>(Specify)</i></p>
<p><b>38b. OTHER RISK FACTORS FOR THIS PREGNANCY</b> <i>(Complete all items)</i></p> <p>Tobacco use during pregnancy ..... Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p style="padding-left: 20px;">Average number cigarettes per day _____</p> <p>Alcohol use during pregnancy ..... Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p style="padding-left: 20px;">Average number drinks per week _____</p> <p>Weight gained during pregnancy _____ lbs.</p>	<p><b>41. METHOD OF DELIVERY</b> <i>(Check all that apply)</i></p> <p>Vaginal ..... 01 <input type="checkbox"/></p> <p>Vaginal birth after previous C-section ..... 02 <input type="checkbox"/></p> <p>Primary C-section ..... 03 <input type="checkbox"/></p> <p>Repeat C-section ..... 04 <input type="checkbox"/></p> <p>Forceps ..... 05 <input type="checkbox"/></p> <p>Vacuum ..... 06 <input type="checkbox"/></p>	<p><b>42. ABNORMAL CONDITIONS OF THE NEWBORN</b> <i>(Check all that apply)</i></p> <p>Anemia (Hct. &lt; 39/Hgb. &lt; 13) ..... 01 <input type="checkbox"/></p> <p>Birth injury ..... 02 <input type="checkbox"/></p> <p>Fetal alcohol syndrome ..... 03 <input type="checkbox"/></p> <p>Hyaline membrane disease/RDS ..... 04 <input type="checkbox"/></p> <p>Meconium aspiration syndrome ..... 05 <input type="checkbox"/></p> <p>Assisted ventilation &lt; 30 min ..... 06 <input type="checkbox"/></p> <p>Assisted ventilation ≥ 30 min ..... 07 <input type="checkbox"/></p> <p>Seizures ..... 08 <input type="checkbox"/></p> <p>None ..... 00 <input type="checkbox"/></p> <p>Other ..... 09 <input type="checkbox"/></p> <p style="text-align: center;"><i>(Specify)</i></p>
<p><b>39. OBSTETRIC PROCEDURES</b> <i>(Check all that apply)</i></p> <p>Amniocentesis ..... 01 <input type="checkbox"/></p> <p>Electronic fetal monitoring ..... 02 <input type="checkbox"/></p> <p>Induction of labor ..... 03 <input type="checkbox"/></p> <p>Stimulation of labor ..... 04 <input type="checkbox"/></p> <p>Tocolysis ..... 05 <input type="checkbox"/></p> <p>Ultrasound ..... 06 <input type="checkbox"/></p> <p>None ..... 00 <input type="checkbox"/></p> <p>Other ..... 07 <input type="checkbox"/></p> <p style="text-align: center;"><i>(Specify)</i></p>		

The format shown above is for live births. The standard format for fetal death reports is essentially the same, differing only in several respects: (a) a seventh method of delivery ("hysterotomy/hysterectomy") is added, (b) the section on abnormal conditions of the newborn is omitted, and (c) congenital anomalies are of the "fetus" rather than the "child".

each. Any errors which may have taken place that year are understandable and likely to have been corrected by now. The intent of this component was simply to develop certain basic insights concerning the workings of the **checkbox** concept.

o **Component 2 (Underlying Cause of Fetal Death)**

All fetal death reports, regardless of format, contain a **cause-of-death** section which reports the immediate cause of death followed by up to two antecedent causes (conditions that gave rise to the immediate cause). **JWK's** task with respect to this component, as set forth in the Statement of Work, was to:

- (1) Study the causes of death reported on each record and determine, using NCHS coding rules, which of the causes was "**underlying**".
- (2) Evaluate "**the** quality and completeness of cause-of-death information on fetal death **records**" insofar as the ability to determine the underlying cause is concerned.

By decision of the project advisory panel, no explicit search was to be conducted for discrepancies between the vital record and the **NMIHS**. There were two reasons for this:

- a. The NMIHS contains no single data element directly relating to cause of death.
- b. To establish decision rules for what constitutes a "**discrepancy**" would be speculative at best.

The study universe for this component exceeds that for Component 1, since it is not limited to the so-called "**checkbox**" states. In all, 43 jurisdictions submitted fetal death reports for 1988. The breakdown by jurisdiction is shown in Exhibit 2.

EXHIBIT 2. FETAL DEATH REPORTS RECEIVED

	<u>Number of Fetal Death Reports</u>		<u>Number of Fetal Death Reports</u>
Alabama	<b>133</b>	Missouri	
Alaska	7	Nebraska	
Arizona	70	Nevada	
California	926	New Hampshire	
Colorado	38	New Jersey	
Connecticut	21	New Mexico	
Delaware	13	New York City	
Florida	282	North Carolina	
Georgia	<b>218</b>	Ohio	
Hawaii	19	Oklahoma	
Idaho	47	Oregon	
Illinois	277	Pennsylvania	
Indiana	122	Rhode Island	
Iowa	42	South Carolina	
Kansas	26	Tennessee	
Kentucky	<b>80</b>	Texas	
Louisiana	109	Utah	
Maine	14	Vermont	
Maryland	62	Virginia	
Massachusetts	27	West Virginia	
Minnesota	31	Wyoming	
Mississippi	96		

o Component 3 (Industry and Occupation)

This component is designed to address "the types and frequency of discrepancies between the reporting of industry and occupation on **states'** vital records and the **NMIHS**". The states (including New York City) that furnished information on industry and occupation in 1988 are as follows:

	<u>No. of Records</u>			<u>No. of Records</u>	
	<u>Live Birth</u>	<u>Fetal Death</u>		<u>Live Birth</u>	<u>Fetal Death</u>
Alabama	280	132	Nevada	56	.
California		917	New York	440	
Connecticut	23		New York City	726	320
Indiana		114	Texas	1,243	108
Maine	27	15	Utah	117	31
New Hampshire		28	Washington	59	2
North Carolina		140	Wisconsin	241	4 2
				3,210	1,849

The industry and occupation of both the mother and the father are treated in this portion of the study: all states that reported one reported the other.

o Component 4 (Multiple Causes of Death)

This component is an extension of Component 2, added through contract amendment. Again, it consists of two separate sets of activities:

- The first was to code "all listed causes of death ... from the 4,000 fetal death reports used in the 1988 **NMIHS**".
- The second was to "analyze multiple cause of death data in the same manner as underlying cause of death is analyzed in Component 2".

The jurisdictions that submitted fetal death reports relevant to this component were previously identified in Exhibit 2.

### 1.3 Data Sources

Three data sources were used to perform this study:

- a. Vital records. - The live birth certificates and fetal death reports received from each of the participating jurisdictions.
- b. Mother's file. - A collection of computer tapes in which are stored the responses provided by the mothers in the 1988 **NMIHS** sample. The data elements stored are drawn from a 35-page survey instrument with section headings as follows:

Part A - Prenatal Care and Health Habits

Part B - Delivery of Your Baby

Part C - Other Pregnancies

Part D - Mother's Characteristics

Part E - Father's Characteristics

Part F - Family Income

- c. Hospital/Provider (H/P) File. - A collection of computer tapes in which are stored additional data elements concerning the mother, infant, and/or fetus, as reported by up to seven prenatal care providers and **by the** hospital(s) responsible for delivery and/or postnatal care. The prenatal care provider and hospital questionnaires are 16 and 32 pages respectively.

The Mother's File was furnished to **JWK** International in June 1991 and the H/P File in June 1992. Documentation concerning these files is available from the Followback Survey Branch of the Division of Vital Statistics of the National Center for Health Statistics.

#### 1.4 Organization of This Report

Each of the ensuing chapters of this report is devoted to a separate component of the study. For convenience, the order of presentation is altered slightly -- Components 2 and 4, both dealing with cause of fetal death, are presented last.

Chapters 2 (Checkbox Items) and 3 (Industry and Occupation) are each organized in two sections. The first is an assessment of the quality and completeness of the vital record in and of itself. The second is an assessment of observed discrepancies between the vital record and NMIHS. Since some of these data elements may, in the case of the mother's file, be imputed, the issue of imputation and its impact on the discrepancy rate is treated as well.

Chapters 4 and 5 address, respectively, the underlying cause and multiple causes of fetal death. Since the notion of "**discrepancy**", as it relates to fetal death, was defined to be moot, both chapters deal solely with the contents of the vital record:

- Chapter 4 outlines the procedures, based on NCHS coding rules, used by JWK to identify the underlying cause of death. The chapter then addresses the issue of quality and completeness, asking in effect: "**Did** the cause-of-death section of the fetal death report contain sufficient information to permit the underlying cause to be determined?"
  
- Chapter 5 extends the discussion to two special topics of interest: (a) the relationship between the first- and **second**-listed causes of death, and (b) the degree of correspondence between information reported in the cause-of-death and **checkbox** sections respectively.

All chapters discuss both methodology and findings. Conclusions and recommendations **are presented as appropriate.**

## 2. CHECKBOX ITEMS

### 2.1 Quality and Completeness of the Vital Record

The standard **checkbox** format for live births, previously shown in Exhibit 1, involves seven major sections. The section headings and contents of each are briefly summarized below:

<u>Section Headina</u>	<u>Contents</u>
Medical Risk Factors for This Pregnancy	Anemia, cardiac disease, and fourteen others, plus <b>"None"</b> and <b>"Other"</b> .
Other Risk Factors for This Pregnancy	Questions on tobacco use, alcohol use, and weight gain.
Obstetric Procedures	Amniocentesis, electronic fetal monitoring, and four others, plus <b>"None"</b> and <b>"Other"</b> .
Complications of Labor and/or Delivery	Febrile, meconium moderate to heavy, and thirteen others, plus <b>"None"</b> and <b>"Other"</b> .
Method of Delivery	Vaginal, vaginal after previous C-section, and four others.
Abnormal Conditions of the Newborn	Anemia, birth injury, and six others, plus <b>"None"</b> and <b>"Other"</b> .
Congenital Anomalies of Child	Anencephalus, <b>spina</b> bifida, and nineteen others, plus <b>"None"</b> and <b>"Other"</b> .

As noted in Exhibit 1, the standard **checkbox** format for fetal deaths is essentially the same as that for live births, differing only in the following respects:

- a. A seventh method of delivery ("**hysterotomy/hysterectomy**") is added.

- b. There is no section on Abnormal Conditions of the Newborn.
- c. Congenital Anomalies are of the **"fetus"** rather than the **"child"**.

As implied by its title, the **checkbox** format entails essentially no written input. While the section on Other Risk Factors requires three numerical entries (average number of cigarettes per day, average number of drinks per week, number of pounds gained during pregnancy), the other sections require no written input at all except when **"Other"** is checked.

In 1988, of the states that submitted vital records for use in this study, the following used the standard **format** without modification:

Live Births

Alabama  
Hawaii  
Indiana  
Kentucky  
Maine  
Nevada  
North Carolina

Fetal Deaths

Alabama  
Indiana  
New Hampshire  
North Carolina

The following **states**<sup>1</sup> used a format similar to that of the U.S. Standard but differing in one or more respects:

Live Births

Connecticut  
Georgia  
New York  
New York City  
Washington

Fetal Deaths

Connecticut  
Kansas  
Maine  
New Mexico  
New York City

---

<sup>1</sup> The term **"state"** will, throughout this report, be understood to apply to New York City as well.

Where modifications were made, the nature of the modification varied. Some states made only minor changes, retaining all (or essentially all) of the standard items and adding a few others. The Connecticut live birth certificate, for example, included "HIV+" under Medical Risk Factors, and **"HIV+"** and "chemical dependency" under Abnormal Conditions of the Newborn. New York City added "preeclampsia" under Medical Risk Factors and divided "uterine bleeding" by trimester; questions on drug dependency and on the use of sedatives, tranquilizers, and anticonvulsants were added to the section on Other Risk Factors: and so on.

Other states made more extensive changes. Georgia and Washington omitted the section on obstetric procedures and configured the remaining sections somewhat differently, retaining many standard items but also adding a few and dropping a number of others. Neither Georgia nor Washington included checkboxes for "uterine bleeding", "incompetent cervix", and several other standard risk factors, but added boxes on drug dependency, rubella, and syphilis.

This portion of the study addresses the issue of quality and completeness from the standpoint of the vital record in and of itself, i.e., without reference to information contained in either the mother's or H/P file of the NMIHS. From that standpoint, two measures of the constructs "quality" and "completeness" seem relevant:

- a. The frequency with which entire **checkbox** sections were omitted, i.e., nothing was checked, not even **"None"**.
- b. The frequency with which positive entries were made, i.e., boxes other than "None" were checked.

Patterns in these frequencies, particularly between live birth certificates and fetal death reports, were examined, with the following results:

Frequency with which entire **checkbox** sections were omitted

The fact that no boxes were checked in a particular section does not necessarily mean the section was overlooked; conceivably, none of the boxes in that section might have been applicable. The fact, however, that not even "**None**" was checked lends an element of ambiguity to the situation, not conducive to reliable reporting. Ambiguities of this sort were relatively rare in live birth certificates but quite common in fetal death reports, as shown below:

	<u>Percentage of Times Entire Section Was Omitted</u>	
	<u>Live Birth Certificates</u>	<u>Fetal Death Reports</u>
Medical Risk Factors	1.8%	13.5%
Obstetric Procedures	<b>5.3%*</b>	13.3%
Complications of Labor and/or Delivery	1.5%	15.6%
Method of Delivery	<b>5.0%*</b>	5.5%
Abnormal Conditions of the Newborn	1.3%	NA

\* Each of these numbers is skewed upward by an unusually high percentage of omissions in a single state (**not the same** in both cases). If the outliers are excluded, the percentage of omissions drops to 1.6% for Obstetric Procedures and 2.1% for Method of Delivery.

The low rate of omission for entire **checkbox** sections in the case of live birth certificates -- generally 2% or less -- implies a greater attentiveness to this portion of the vital record when the event involved is a live birth. The substantially higher rate for fetal deaths is consistent with prior NCHS experience which indicates that missing entries in fetal death reports, for reasons believed to be related to priority and sensitivity, generally

receive less vigorous follow-up at the state level than those involving live births.

Frequency with which positive entries were made

Another plausible basis for assessing the quality and completeness of the data involves dichotomizing all **checkbox** entries into two groups: positive and negative, and searching for patterns. Negative entries are those in which either the box marked **"None"** was checked or no boxes were checked at all; positive entries are anything else. The results of this exercise, aggregated across all states that submitted reports, are as follows:

	Percentage of Vital Records <u>Containing Positive Entries</u>	
	<u>Live Birth</u> <u>Certificates</u>	<u>Fetal Death</u> <u>Reports</u>
Medical Risk Factors	24.2%	36.2%
Obstetric Procedures	81.7%	68.9%
Complications of Labor and/or Delivery	37.0%	44.3%
Method of Delivery	95.0%	94.5%
Abnormal Conditions of the Newborn	11.4%	NA

The patterns observed in this table (apart from the roughly 5% omission rate for Method of Delivery) seem reasonable. In particular, the differences between live births and fetal deaths appear to move in the right direction. One would naturally expect fetal deaths, as opposed to live births, to be accompanied by a greater percentage of medical risk factors and complications of labor and/or delivery, and by a lower percentage of obstetric procedures (amniocentesis, electronic fetal monitoring, and the like) normally associated with higher orders of care. The preceding table shows this to be the case.

## 2.2 Discrepancies Between Vital Record and NMIHS

The second basic area of study conducted in connection with this component consisted of a search for discrepancies between the information reported in the vital record and that reported in the NMIHS. This portion of the study focused chiefly on the variables "alcohol **use**", "tobacco use", and "weight **gain**", contained in the **checkbox** section labeled Other Risk Factors.

### Basic Tabulations

In an effort to gain a feeling for the manner in which the data fall, basic frequency counts for alcohol use, tobacco use, and weight gain were generated. These counts are presented in Exhibits 3 through 5 respectively. Each table shows, by state, the percentage distribution of replies provided by mothers in the NMIHS sample compared to that reported in the vital record. Pertinent observations are as follows:

1. Alcohol Use (Exhibit 3). - The vital records in most states indicate that over 95% of mothers abstained throughout their pregnancy -- had zero drinks per week. Mothers in the NMIHS, however, reported substantially lower rates of abstention, ranging from 67 to 94 percent. One of the reasons for the apparent discrepancy may be a matter of coding: the NMIHS question on alcohol calls for coded responses and includes a number of less-than-once-a-week categories -- "2 to 3 drinks a month", "1 drink a month", "less than 1 drink a month" -- whereas the vital record simply **calls** for a single numerical entry, the average number of drinks per week. Many of the smaller coded values in the NMIHS tended to be reported in the vital record as zero (see analysis of linked records, presented below): in virtually every state the vital record percentage for "0" is seen to be roughly comparable to the NMIHS percentage for "0" and "<1" combined.

EXHIBIT 3.  
MOTHER'S ALCOHOL CONSUMPTION DURING PREGNANCY, BY STATE

	NMIHS					VITAL RECORD				
	N	Percentage Distribution of Values ("Number of Drinks per Week")*				N**	Percentage Distribution of Values ("Number of Drinks per Week")*			
		0	<1	1-2	3+		0	<1	1-2	3+
AL-LB	236	91	7	1	1	222	99	-	1	0
-FD	95	87	8	1	3	92	100	-	0	0
CT-LB	16	94	6	0	0	11	100	-	0	0
-FD	16	75	13	13	0	16	100	-	0	0
GA-LB	436	88	8	3	2			NA		
HI-LB	30	80	10	3	7	29	100	-	0	0
IN-LB	89	84	15	1	0	85	95	-	0	5
-FD	93	89	6	1	3	92	99	-	0	1
KS-FD	21	67	33	0	0	21	100	-	0	0
KY-LB	127	85	13	2	0	127	98	-	2	1
ME-LB	25	80	16	0	4	24	100	-	0	0
-FD	10	90	10	0	0	8	100	-	0	0
NV-LB	43	72	21	5	2	29	90	-	7	3
NH-FD	16	81	13	0	6	15	100	-	0	0
NM-FD	10	90	0	10	0	10	100	-	0	0
NY-LB	353	78	16	4	2	353		(P = 95%***)		
NYC-LB	458	85	9	3	3	458		(p = 95%***)		
-FD	163	85	10	1	3	161		(p = 92%***)		
NC-LB	314	92	6	1	1	307	97	-	2	1
-FD	110	88	6	2	4	102	100	-	0	0
WA-LB	43	72	26	0	2			NA		

NA: Vital record in this state omits question on alcohol use.

\* Because of rounding, percentages may not sum to 100%.

\*\* Excludes entries that are missing, illegible or otherwise not useful.

\*\*\* Vital record format permits binary answers only. Percentage shown is the percentage who answered "No".

2. Tobacco Use (Exhibit 41). - As in the case of alcohol, consumption rates of zero were reported substantially more often, by a wide margin and with only one exception, in the vital record than the NMIHS. This time, however, the differences cannot be ascribed to coding: both the vital record and the NMIHS report the use of tobacco in the same manner, as an **uncoded** integral value -- the average number of cigarettes smoked per day.

The lower percentage of zeros in the NMIHS is seen to be accompanied by a higher percentage of values in the range of **1 to 4**. It was initially conjectured that some of these small values might be reporting errors, i.e., might pertain to the number of packs, not cigarettes, smoked per day. Analysis of the linked records, however, showed this not to be the case. A more plausible explanation, as in the case of alcohol use, is that extremely low consumption rates, not uncommon in the NMIHS, tend to be ignored -- i.e., reported as zero -- in the vital record.

3. Weight Gain (Exhibit 5). - The most striking aspect of the weight gain distributions is the large number of negative weight gains (weight **"losses"**) seemingly reported by mothers in the NMIHS. The important point to note here is that NMIHS weight gain is a calculated value, the difference between data elements SC215 ("weight just before delivery") and SC211 ("weight just before you became pregnant"), whereas the vital record weight gain is a reported value, a single numerical entry. The differences between the two distributions are seen to be quite pronounced: losses in excess of 25 pounds are non-existent in the case of the vital record, and losses between 1 and 25 pounds extremely rare whereas in the **case** of the NMIHS, losses in excess of 25 pounds are noted quite often. Some of the losses are unnaturally large: the following table shows the largest single negative weight gain

EXHIBIT 4.  
MOTHER'S TOBACCO CONSUMPTION DURING PREGNANCY, BY STATE

	NMIHS					VITAL RECORD				
	N	Percentage Distribution of Values ("Number of Cigarettes per Day")*				N**	Percentage Distribution of Values ("Number of Cigarettes per Day")*			
		0	1-4	5-19	20+		0	1-4	5-19	20+
AL-LB	236	78	5	10	2	221	<b>89</b>	1	7	4
-FD	95	73	11	13	4	90	87	0	7	6
CT-LB	16	94	0	0	6	11	91	9	0	0
-FD	16	69	13	6	13	14	100	0	0	0
GA-LB	436	80	5	11	4			NA		
HI-LB	30	77	3	13	7	28	89	4	4	4
IN-LB	89	66	8	15	11	89	74	1	19	6
-FD	93	71	2	16	11	87	75	0	15	10
KS-FD	21	76	0	19	5	21	100	0	0	0
KY-LB	127	72	4	13	11	127	82	2	7	9
ME-LB	25	80	0	8	12	24	96	0	0	8
-FD	10	70	0	30	0	8	<b>75</b>	0	25	0
NV-LB	43	72	12	14	2	29	86	3	3	7
NH-FD	16	81	0	19	0	16	88	0	6	6
NM-FD	10	80	10	0	10	10	100	0	0	0
NY-LB	353	72	6	15	6	352	(p = <b>83%</b> )***			
NYC-LB	458	77	5	12	5	458	(p = <b>70%</b> )***			
-FD	163	80	8	8	3	162	(p = <b>64%</b> )***			
NC-LB	314	80	4	10	6	300	84	2	7	
-FD	110	78	5	12	5	101	80	3	12	
WA-LB	43	84	5	9	2	41	(p = <b>88%</b> )***			

NA: Vital record in this state omits question on tobacco use.

\* Because of rounding, percentages may not sum to 100%.

\*\* Excludes entries that are missing, illegible or otherwise not useful.

\*\*\* Vital record format permits binary answers only. Percentage shown is the percentage who answered "No".

EXHIBIT 5.  
MOTHER'S WEIGHT GAIN DURING PREGNANCY/BY STATE

	<u>NMIHS</u>					<u>VITAL RECORD</u>				
	<u>N</u>	Percentage Distribution of Values (" <b>Pounds</b> Gained or <b>Lost</b> ")*				<u>N**</u>	Percentage Distribution of Values (" <b>Pounds</b> Gained or <b>Lost</b> ")*			
		<u>Loss</u> <u>≥ 5</u>	<u>Loss</u> <u>1-25</u>	<u>Gain</u> <u>0-25</u>	<u>Gain</u> <u>&gt; 25</u>		<u>Loss</u> <u>&gt; 25</u>	<u>Loss</u> <u>1-25</u>	<u>Gain</u> <u>0-25</u>	<u>Gain</u> <u>≥ 5</u>
AL-LB	236	1	3	47	49	<b>196</b>	0	1	47	52
-FD	95	3	3	56	38	63	0	0	59	41
CT-LB	16	6	<b>0</b>	38	56			NA		
-FD	16	6	<b>6</b>	50	38			NA		
GA-LB	436	2	<b>3</b>	45	50			NA		
HI-LB	30	0	<b>0</b>	47	53	26	0	0	46	54
IN-LB	89	0	<b>0</b>	45	55	85	0	0	100	0
-FD	93	2	<b>2</b>	43	53	74	0	0	55	45
KS-FD	21	0	<b>0</b>	48	52	19	0	0	58	42
KY-LB	127	2	4	49	46	122	0	0	62	38
ME-LB	25	0	0	20	80	21	0	0	29	71
-FD	10	0	0	30	70	5	0	0	60	40
NV-LB	43	0	0	49	51	23	0	0	48	52
NH-FD	16	0	0	38	63	11	0	0	55	45
NM-FD	10	10	0	50	40			NA		
NY-LB	353	2	1	41	57	279	0	1	39	60
NYC-LB	458	1	5	47	47	280	0	0	49	51
-FD	163	2	3	50	45	74	0	1	55	43
NC-LB	314	1	2	46	51	272	0	0	52	48
-FD	110	1	4	51	45	84	0	0	57	43
WA-LB	43	0	2	33	65			NA		

NA: Vital record in this state omits question on weight gain.

\* Because of rounding, percentages may not sum to 100%.

\*\* Excludes entries that are missing, illegible or otherwise not useful, \_

in each of several states, as calculated from the NMIHS file and as reported in the vital record respectively:

	<u>Largest Single Negative Weight Gain</u>	
	<u>As calculated in the NMIHS</u>	<u>As reported in the vital record</u>
State A-LB	-77	-6
A-FD	-52	0
State B-LB	<b>-58</b>	NA
B-FD	<b>-218</b>	NA
State C-LB	-78	0
State D-FD	-56	0
State F-LB	-30	0
State G-LB	-73	-2
G-FD	-a3	-10
State H-LB	-41	0
H-FD	-76	0

NA: Question on weight gain not included in the vital record format for this state.

These discrepancies raise certain obvious questions regarding the NMIHS weight gain, not the vital record. Subtracting the mother's reported weight prior to pregnancy (data element **SC211**) from her reported weight prior to delivery (SC215) clearly can lead to erratic results, a tip-off that one or both of these elements might be in error. Either the former was overstated, the latter understated, or some combination of both took place. Further analysis of this issue is contained in the comparison of linked records which follows.

#### Comparison of Linked Records

The vital records submitted by the states were matched, by ID number, with the corresponding record in the NMIHS file. The linkage (and consequent analysis) was accomplished in two stages:

- a. Since the mother's file was available twelve months before the H/P file, the linkage between it and the vital record was studied first (Stage 1).
- b. When the H/P file later became available, linked comparisons involving all three data sources were performed (Stage 2). The analysis was extended at that point to include **"method of delivery"** as well.

Both sets of comparisons are presented below.

o Staae 1: Vital Record vs. Mother's File

Appendices A through C contain matrices which show, state by state, the joint distribution of values for the variables "alcohol use", "tobacco use", and "weight gain" respectively. Summary findings are as follows:

Alcohol Use (Appendix A)

For the purpose of analysis and summary presentation, the spectrum of alcohol usage (number of drinks per week) was coded as follows: 0, <1, 1-2, 3-5, 6-8, 9-13, and 14 or more, corresponding roughly to the coding employed in the NMIHS. A discrepancy was defined as any point lying off the diagonal in Appendix A, i.e., any pair of values that fall in different intervals (counting "0" and "<1" as **equivalent**).<sup>2</sup>

Summing across all states in Appendix A, the discrepancy rate for alcohol use was found to be slightly under 5% (54 discrepant cases

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<sup>2</sup> This definition of discrepancy is admittedly a simplification since it is possible for two values to fall in the same interval yet differ numerically. However, such cases were, in the case of alcohol consumption, relatively rare and of minor consequence.

in a total of 1,183 matched records). The NMIHS value was greater in 34 of these cases and the vital record value in 20.

#### Tobacco Use (Appendix B)

The spectrum of tobacco consumption (number of cigarettes per day) was divided as follows: 0, 1-2, 3-5, 6-10, and greater than 10. These intervals are roughly comparable to those used to categorize alcohol use.

Summing across states, the discrepancy rate for tobacco use was found to be four times that for alcohol -- 217 discrepancies in 1,176 matched records, or 18.5%. As with alcohol, NMIHS consumption values tended, in the case of discrepancy, to exceed the vital record value: 139 cases moved in the former direction and 78 in the latter.

#### Weight Gain (Appendix C)

Because of the broader spectrum of values involved, the mode of presentation for weight gain differs slightly from that employed in the case of alcohol and tobacco use. The distributions shown in Appendix C reflect the difference between the NMIHS and vital record weight gains, as a function of the mother's weight prior to pregnancy. Positive differences denote the NMIHS weight gain was larger; negative differences denote the opposite. Pertinent observations are as follows:

1. Match rate. - If a match is defined as any pair of values that come within five pounds of each other (i.e., the center column in Appendix C), most states showed match rates between 30 and 60 percent. Only one state showed a match rate materially below these values and only two states, both with small numbers of records, showed match rates materially greater. The match rate for all states combined was 40%.

2. Relative values, NMIHS vs. vital record. - Where the two weight gains failed to match (differed by more than five pounds), the NMIHS weight gain was more likely to be the greater. There were 587 such cases compared to 393 in which the situation was reversed. The full distribution of weight gains, summed over all states, was as follows:

	<u>Number of Cases</u>	<u>Pct.</u>
NMIHS and vital record weight gains within five pounds of each other	654	40%
NMIHS gain exceeded vital record gain:	(587)	(36%)
-- Between 6 and 20 pounds	376	23%
-- Between 21 and 50 pounds	184	11%
-- By more than 50 pounds	27	2%
Vital record gain exceeded NMIHS gain:	(393)	(24%)
-- Between 6 and 20 pounds	300	18%
-- Between 21 and 50 pounds	75	5%
-- By more than 50 pounds	18	1%

3. Relationship to mother's weight. -- Generally speaking, discrepancies in weight gain appear to be independent of the mother's weight prior to pregnancy. This feature is evident from Exhibit 6 which shows the joint distribution of discrepancies and mother's weight, summed over all states. For all levels of discrepancy, the mother's weight prior to pregnancy is seen to be distributed in roughly the same manner (110 to 129 pounds most common, with 130 to 149 pounds a close second), with one exception -- for those mothers whose vital record gain exceeded their NMIHS gain by more than 50 pounds, the vast majority (twelve out of eighteen) were recorded as having pregravid weights greater than 169 pounds. Putting it another way, six percent of these heavier mothers (twelve cases out of 207) displayed discrepancies of this nature and magnitude versus none of the lighter mothers (zero out of 182)

EXHIBIT 6. DISTRIBUTION OF WEIGHT GAIN DISCREPANCIES  
BY MOTHER'S WEIGHT PRIOR TO PREGNANCY

Mother's weight prior to pregnancy:	Number of Cases				
	<u>&lt;110</u>	<u>110- 129</u>	<u>130- 149</u>	<u>150- 169</u>	<u>&gt;169</u>
NMIHS and vital record weight gains within five pounds of each other	<b>a3</b>	226	190	90	65
NMIHS gain exceeded vital record gain:					
-- Between 6 and 20 pounds	44	122	104	62	44
-- Between 21 and 50 pounds	22	63	56	19	24
-- By more than 50 pounds	3	9	9	3	3
Vital record gain exceeded NMIHS gain:					
-- Between 6 and 20 pounds	27	94	<b>88</b>	49	42
-- Between 21 and 50 pounds	3	20	<b>18</b>	17	17
-- By more than 50 pounds	0	3	1	2	12
TOTALS	1a2	537	466	242	207

and less than one percent of the others (six out of 1,245). The question arises: why are heavy mothers so much more likely to have their NMIHS weight gain vastly understated -- by more than 50 pounds -- compared to the vital record?

The answer, one surmises, may lie in the possibility that these mothers were not really heavy -- their pregravid weight was simply, for whatever reason, overstated. This would naturally cause these mothers to appear heavy and would also cause their weight gain, measured through subtraction, to be correspondingly understated. The comfort one feels with this conjecture stems not only from the fact that it offers a logical explanation for the situation described, it also accounts for the unusually large number of negative weight gains in general noted earlier."

At least some of the anomalies noted on these pages may be a survey artifact, the product of imputation. Following a time-honored practice, virtually all missing data elements in the NMIHS (including, in this instance, mother's pregravid and/or predelivery weight) are imputed. The extent to which this phenomenon takes place and an analysis of its impact on the apparent discrepancy rate are discussed next.

### The Extent and Impact of Imputation

Of the three variables treated in this portion of the study -- alcohol use, tobacco use, and weight gain -- only weight gain is

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<sup>3</sup> This conjecture, if true, has strong implications for the accuracy of any research based on NMIHS data elements SC211 (pregravid) and SC215 (predelivery) weight. One possible solution might be to add a question to the survey instrument asking the mother to explicitly report her weight gain in pounds (as in the vital record). While this would not necessarily "**correct**" either of these data elements when they are wrong, it would at least raise an important flag.

subject to any appreciable degree of imputation. Of the records studied, alcohol and tobacco use were imputed in only slightly over one percent of the cases, too small a percentage to be of any consequence, while one or both of the elements involved in the weight gain computation (pregravid weight, predelivery weight, or both) were **imputed** roughly eight percent of the time. The latter findings, and their implications, are described below.

Weight gain. - Of the 1,634 records studied, 1,504 (92%) involved no imputation at all. The remaining 130 records were divided as follows:

- o In 53 cases, the mother's weight prior to delivery was imputed but not her weight prior to pregnancy.
- o In 21 cases, the mother's weight prior to pregnancy was imputed but not her weight prior to delivery.
- o In 56 cases, both weights were imputed.

The distribution of discrepancies in each of these situations is shown below:

<u>Imputed Weight</u>	Discrepancy in Pounds (defined as NMIHS weight gain minus vital record weight gain)						>50
	<50	-50 to -21	-20 to -6	-5 to 5	6 to 20	21 to 50	
Neither (N = 1,504)	<1%	4%	19%	42%	23%	10%	1%
Pregravid only (N = 21)	5%	24%	10%	19%	5%	29%	9%
Predelivery only (N = 53)	13%	17%	9%	8%	17%	23%	13%
Both (N = 56)	0%	11%	12%	29%	23%	21%	4%

The preceding table presents a number of interesting features:

1. The tails, starting at plus or minus 21 pounds, contain a surprisingly large percentage of cases. Even where imputation was not involved, discrepancies of 21 pounds or more were observed over 15% of the time.
2. Not surprisingly, the tails were more pronounced when imputation was performed. Interestingly, the degree of correspondence was poorer when only one weight was imputed than when both were:

	<u>Percentage of weight gain discrepancies that were</u>		
	<u>Fairly close</u> (less than 5 lbs. apart)	<u>Moderately</u> large (more than 20 lbs.)	<u>Extremely</u> large (more than 50 lbs.)
No imputation	42%	16%	2%
Both weights imputed	29%	36%	4%
One weight imputed but not the other	11%	66%	23%

3. Finally, a clear lack of symmetry was observed between discrepancies that were negative (i.e., the vital record weight gain exceeded the NMIHS weight gain) and those that were positive:

	<u>Vital record value</u> exceeded NMIHS value by more than 5 lbs.	<u>NMIHS value exceeded</u> vital record value by more than 5 lbs.
No imputation	24%	34% (p < .001)
Both weights imputed	23%	48% (p < .05)
One weight imputed:		
Pregravid	39%	43% (not signif.)
Predelivery	39%	53% (not signif.)

The dynamics that cause the NMHIS weight gain to exceed, generally, that reported in the vital record -- and that seemingly create an even greater disparity when one or both of the weights that contribute to the computation is imputed -- may warrant further study.

o Staae 2: Comparisons Involving the H/P File

With the availability in June 1992 of the H/P file, comparisons involving all **three** data sources became possible. Although much of the H/P file is clinical in nature, attention in this portion of the study focused on the three non-clinical variables "**alcohol use**", "**tobacco use**", and "**weight gain**", the goal being to determine the extent to which these items are usefully and reliably reported. In addition, a fourth variable ("method of delivery", not included in the mother's file) was examined from the standpoint of two-way differences between the vital record and the H/P file.

The character locations in the H/P file that contain information on these items are as follows:

Alcohol Use

8830-8832            Number of drinks per week (includes "0")

Tobacco Use

8823-8824            Did mother smoke during pregnancy? (Yes/No)

**8826-8828**            Number of cigarettes per day

Weight Gain

6745-6747            Mother's pregravid weight

9988-9990            Mother's weight when admitted for delivery

Method of Delivery

10132-10134          Type of delivery (ten checkboxes, including  
"Other")

The manner in which these items were processed and analyzed vis-a-vis those in the vital record and mother's file is described below.

o Alcohol Use

For each of the files, the format used to describe mother's alcohol use during pregnancy is shown below:

<u>Source</u>	<u>How Alcohol Use is Reported</u>
Vital record	Uncoded number of drinks per week.
Mother's file	Location 1236-37: 01 denotes "Yes" 02 denotes "No"
	Location 1241-43: 11 coded values (001-011)
H/P file	Location 8830-32: Uncoded number of drinks per week.

Previously, in Stage 1, it had been shown that there were 1,183 cases in which both the mother's file and the vital record contained useful entries concerning alcohol use. In 769 of these cases, the H/P entry proved useful as well.' To assess the intersource reliability of these records with respect to this particular data element, the following steps were taken:

Step 1. Both the vital record and the H/P values were recoded, using the same coding intervals as the mother's file. [NOTE: Codes 008 through 010 in the mother's file pertain to frequencies involving less than one drink per week. Since the vital record and H/P files report integer values only, there is no possibility of a match

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\* In the H/P file, unlike the mother's file, no imputation was performed for missing entries, thus reducing the number of records available for comparison. This comment holds for tobacco use and weight gain as well.

for these codes. They were therefore recoded, when they appeared, to code 011 ("**None**"). The latter code was also assigned to mothers who were not asked this question, i.e., whose response in location 1236-37 was "**No**".]

Step 2. After all recodes involving alcohol use were completed, the 769 records whose ID numbers matched in all three files were divided into five groups:

Group 1 - All three coded values were the same.

Group 2 - Only the vital record differed.

Group 3 - Only the mother's file differed.

Group 4 - Only the H/P file differed.

Group 5 - All three files differed.

This set of comparisons showed a 92.5% level of agreement among all three data sources (Group 1), a 4.9% level of partial agreement (Groups 2 through 4), and a 2.6% level of mutual disagreement (Group 5). The relevant numbers and percentages are shown below:

Comparisons involvina alcohol use

	<u>Number of Cases</u>	<u>Percent</u>
All three files agree	711	92.5%
Two out of three agree, the sole exception being the:		
Vital record	11	1.4%
Mother's file	16	2.1%
H/P file	11	1.4%
None of the three agree	20	2.6%

0 Tobacco Use

The format used in the three data files to report tobacco use is as follows:

<u>Source</u>	<u>How Tobacco Use is Reported</u>
Vital record	Uncoded number of cigarettes per day.
Mother's file	Location 1253-54: 01 denotes "Yes" 02 denotes "No"
	Location 1258-60: Uncoded number of cigarettes per day.
H/P file	Location 8823-24: 01 denotes "Yes" 02 denotes "No"
	Location 8826-28: Uncoded number of cigarettes per day.

In Stage 1, considering just the mother's file and vital record, there were a total of 1,176 matched records involving tobacco use. Introducing the H/P file reduced the number of matches to 881 (see footnote 4). Comparison of these items paralleled that taken in the case of alcohol use:

- Step 1. All three values were recoded using a slightly modified version of the coding intervals used in **Stage 1**: 0, 1-2, 3-5, 6-10, 11-20, and >20.
- Step 2. After recoding was complete, the 881 records whose ID numbers matched in all three files were divided into the five level-of-agreement groups defined earlier.

As in Stage 1, the results of this comparison showed somewhat lower levels of agreement for tobacco use as compared to alcohol. The relevant numbers and percentages were as follows:

Comparisons involving tobacco use

	<u>Number of Cases</u>	<u>Percent</u>
All three files agree	624	70.8%
Two out of three agree, the sole exception being the:		
Vital record	45	5.1%
Mother's file	64	7.3%
H/P file	29	3.3%
None of the three agree	<b>119</b>	13.5%

o Weight Gain

The variables and format used to report weight gain are as follows:

<u>Source</u>	<u>How Weight Gain is Reported</u>
Vital record	<b>Uncoded</b> number of pounds gained during pregnancy.
Mother's file	Location 3014-16: Weight prior to pregnancy.
	Location 3023-25: Weight prior to delivery.
H/P file	Location 6745-47: Weight prior to pregnancy.
	Location 9988-90: Weight prior to delivery.

In Stage 1, the number of matched records involving weight gain, considering only the mother's file and the vital record, was 1,634. Introducing the H/P file reduced the number of matches to 815. Comparison of these items took the following form:

Step 1. In the case of the two NMIHS files (mother's and H/P), the mother's weight prior to pregnancy was subtracted from her weight prior to delivery to derive the estimated weight gain. Both of these values, as well as the weight gain reported directly in the vital record, were recoded using the following intervals: c-25 (i.e., a weight loss greater than 25 pounds), -25 to -11, -10 to -1, 0 to 9, 10 to 19, 20 to 29, 30 to 39, 40 to 49, 50 to 75, and >75.

Step 2. The recoded values were then sorted into five groups as above.

The results of this comparison are summarized below:

<u>Comoarisons involvina weiuhht aain</u>		
	<u>Number of Cases</u>	<u>Percent</u>
All three files agree	162	19.9%
Two out of three agree, the sole exception being the:		
Vital record	109	13.4%
Mother's file	173	21.2%
H/P file	78	9.6%
None of the three agree	293	36.0%

Exhibit 7 compares these percentages with those associated with alcohol and tobacco use. While a strict comparison of these numbers is invalidated by the use of nine coded intervals for weight gain (as opposed to six for the others), the differences are sufficiently pronounced to warrant the conclusion that weight gain enjoys a lower level of unanimity among data sources than either alcohol or tobacco use. Of the three variables, alcohol use is by far the most consistent, with tobacco use a distant second, and weight gain a remote third.

EXHIBIT 7.

COMPARISON OF CODED VALUES OF ALCOHOL USE, TOBACCO USE,  
AND WEIGHT GAIN FOR THREE ALTERNATIVE DATA SOURCES  
(VITAL RECORD, MOTHER'S FILE, AND H/P FILE)

	<u>All three files agree</u>	<u>Two out of three files agree, the sole exception being the</u>			<u>None of the files agree</u>
		<u>Vital Record</u>	<u>Mother's File</u>	<u>H/P File</u>	
Alcohol use (N = 769)	93%	1%	2%	1%	3%
Tobacco use (N = 881)	71%	5%	7%	3%	14%
Weight gain (N = 815)	20%	13%	21%	10%	36%

In those cases where only two of the sources agreed, the mother's file was more likely to be the exception than either of the other two. Chi-square analysis of the numbers in Exhibit 7 (carried to one more decimal place) showed the differences to be statistically significant in the case of tobacco use and weight gain (but not in the case of alcohol use). That is to say, the relative frequency with which the mother's file is the outlier with respect to these two variables differs significantly from the relative frequency associated with either the vital record or the H/P file.

Example: Of the 881 cases involving tobacco use, there were 138 cases in which two of the sources agreed but the third did not. Under the null hypothesis that there are no essential differences among sources, these cases would have divided equally at 46 each. The actual split was:

Vital record the exception:	45 cases
Mother's file the exception:	64 cases
H/P file the exception:	29 cases

The above level of non-uniformity was highly significant ( $p < .01$ ). A similar, even more highly significant finding was noted in the case of weight gain.

### Impact of Imputation

Carrying the analysis a step further, the cases studied were divided, as before, into two groups: those in which the value in the mother's file was imputed and those in which it was not. For alcohol and tobacco use, the number of cases involved was trivial: there were only seven cases of imputation (out of 769) for alcohol use and only six (out of 881) for tobacco use. For weight gain, however, there were 41 records in all (out of 815) in which one or

both of the two key weights was imputed. The respective **level-of-agreement** profiles for the imputed vs. non-imputed cases were as follows:

	<u>All three files agree</u>	<u>Two out of three files agree, the sole exception being the</u>			<u>None of the files agree</u>
		<u>Vital Record</u>	<u>Mother's File</u>	<u>H/P File</u>	
Imputed (N = 41)	5%	2%	32%	0%	61%
Non-imputed (N = 774)	21%	14%	21%	10%	35%

The impact of imputation remains, as noted earlier, strongly evident.

The final step in the analysis was to devise a single index to facilitate the comparison of cases across variables, data sources, and (eventually) time. Variables such as Kappa were considered and rejected as unsuitable in the present context. Unlike "percent agreement", Kappa has the virtue of taking the level of agreement based on chance alone into account; however, it has the disadvantage that its value is not readily interpretable since it depends on the number of coding intervals employed.

The index selected was as follows: the percentage of cases in which a given data source agrees with at least one of the other two sources with respect to a given variable. This index expresses the degree of concordance displayed by any given combination of data source and variable. Its computation is illustrated in the following example:

Considering Exhibit 7, one notes that for the variable **"tobacco use"**, the mother's file agrees with at least one other source (a) whenever all three sources agree (71% of the

time), (b) whenever the vital record is the sole exception (5% of the time), and (c) whenever the H/P file is the sole exception (3% of the time). The sum of these percentages (79%) expresses the degree of concordance for the mother's file with respect to tobacco use.

Values of this measure for all combinations of variable and data source are as follows:

<u>Data Source</u>	<u>Percentage of time the given data source agreed with at least one other data source</u>		
	<u>Alcohol Use</u>	<u>Tobacco Use</u>	<u>Weight Gain</u>
Vital record	96%	81%	51%
Mother's file	95%	79%	43%
H/P file	96%	83%	54%

Again, there is a clear tendency for the mother's file to be the least concordant of the three (i.e., the least likely to agree with the other two), particularly with respect to weight gain. When the results for weight gain are subdivided by imputed vs. non-imputed, the contrast is even sharper, as shown below:

	<u>Percentage of time the given data source agrees with at least one other data source</u>	
	<u>Weight Gain (Imputed)</u>	<u>Weight Gain (Non-imputed)</u>
Vital record	37%	52%
Mother's file	7%	45%
H/P file	39%	55%

What these findings denote, in brief, is the following: when the mother's weight (either pregravid or predelivery) is imputed, the likelihood that the computed weight gain will match either the vital record or the H/P file is extremely remote (7%). When

neither weight is imputed, the likelihood of concordance increases substantially, to 45%.

The final variable treated in this portion of the study is "method of delivery", described below.

o Method of Delivery

Since Method of Delivery does not appear in the mother's file, the analysis that follows centers on the vital record and H/P file.

Live birth certificates that use the standard **checkbox** format feature six choices for Method of **Delivery**:<sup>5</sup>

- o Vaginal
- o Vaginal birth after previous C-section
- o Primary C-section
- o Repeat C-section
- o Forceps
- o Vacuum

The H/P file includes all of these choices, slightly expanded, somewhat differently worded, and presented in the following order:

- o Vaginal birth after previous C-section
- o Spontaneous
- o Forceps - low
- o Forceps - mid
- o Forceps - high
- o Vacuum extraction
- o First C-section
- o Repeat C-section

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<sup>5</sup> Fetal death reports add a seventh item: hysterotomy/ectomy.

Study of some 1,732 matched records that contained useful entries in both the vital record and H/P files showed the following major findings:

- a. The "spontaneous" entry in the NMIHS was matched by "vaginal **birth**" in the vital record almost 98% of the time.
- b. "First C-section" in the NMIHS was matched by "Primary **C-section**" in the vital record 87% of the time.
- c. "Repeat C-section" was matched by the identical item in the vital record 90% of the time.
- d. The overall match rate for all items combined was **88%**, with very little difference between live birth certificates and fetal death reports. Some items, however, showed more than occasional gaps in terms of **checkbox** coverage. "Vaginal birth after previous C-section@", which accounted for about 2% of the NMIHS entries, often showed up in the vital record simply as "**vaginal**". Forceps deliveries and vacuum extractions also tended to go unchecked an appreciable percentage of the time.

### 3. INDUSTRY AND OCCUPATION

#### 3.1 Quality and Completeness of the Vital Record

Parents' industry and occupation, as reported in the vital record, was coded by **JWK** in accordance with the Industrial Classification and Occupational Classification Systems used by the National Center for Health Statistics' Mortality Statistics Branch. The taxonomy used in these systems is described in the Alphabetic Index of Industries and Occupations, 1989.<sup>6</sup>

In the case of occupation, JWK added several additional categories, not part of the original coding scheme. The additional categories were as follows:

- o Disabled
- o Student
- o Homemaker
- o Volunteer

Two subcategories of homemaker were differentiated: (a) mothers who **were** specifically identified as homemakers in the vital record and (b) those who could reasonably be inferred to be homemakers by virtue of not having had a job in the twelve months preceding delivery.

In all, 5,059 records were examined for industry and occupation. The following table shows the number and percentage of records for which information on one or the other of these elements was **either omitted or too vague to be coded:**

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<sup>6</sup> Prepared by the Labor Force Statistics Branch, Housing and Household Economic Statistics Division, of the Bureau of the Census, October 1988.

Number and Percentage of  
Times Information Was Omitted  
or Too Vague to be Coded\*

		<u>Number</u>	<u>Percent</u>
Mother:	Industry	406	8.0%
	Occupation	148	2.9%
Father:	Industry	2,345	46.4%
	Occupation	1,948	38.5%

\* Total number of records = 5,059. See page 6 for a listing of the states involved.

The differences noted between mother and father and between industry and occupation are highly significant, i.e.:

- o Information on mothers was more commonly and fully reported than on fathers.
- o Information on occupation was more commonly and fully reported than on industry.

Several additional "**cuts**" were taken of the data, with the following results:

- a. Live births vs. fetal deaths - **There** is no evidence that industry and occupation were more commonly or fully reported in the **case** of live births as opposed to fetal deaths, or vice versa. Seven states provided both types of records and the evidence was mixed: of the 28 possible comparisons that could be made (seven states times mother and father times industry and occupation), 11 went in one direction and 14 in the other, with three ties.
- b. Year state began reporting industry and occupation. - Some states began reporting industry and occupation in 1988; others started earlier. The differences between these two groups are shown in the following table:

		Percentage of Times Information Was Omitted or Too Vague to be Coded	
		States That Began Reporting in 1988 [N = 786]	States That Began Earlier [N = 4,273]
Mother:	Industry	7.0%	8.2%
	Occupation	4.7%	2.6%
Father:	Industry	58.0%	44.2%
	Occupation	51.5%	36.1%

For mother's industry, the differences between the two percentages are not significant. The other three differences, however, are highly significant, leading to the conjecture that for mother's occupation and for father's industry and occupation, a learning curve phenomenon may be at work.

### 3.2 Discrepancies Between Vital Record and NMIHS

For the purpose of comparing the vital record and the NMIHS with respect to parents' industry and occupation, two categories of "match" were defined:<sup>7</sup>

- o An exact match is one in which the three-digit code assigned by JWK was precisely identical to that reported in the NMIHS mother's file.

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<sup>7</sup> Two features of this component of this study warrant reemphasis at this point. The first is that the states were not responsible for coding industry and occupation. All such items were entered in clear text: **JWK** did the coding. The second is that **JWK** was instructed to code any mother who had not worked in the **past** twelve months as a homemaker. As noted earlier (p. 39), the category "homemaker" therefore includes not only mothers who were explicitly reported as such in the vital record but also those who could reasonably be inferred to be homemakers by virtue of not having worked for the past twelve months. In terms of total number, the latter grouping tended to be small, accounting for only about one-sixth of all homemakers.

- o A near match is one in which the code assigned by JWK, although different from that reported in the mother's file, fell in the same broadly-defined generic category.

The generic categories used to define near matches followed the subdivisions conventionally employed in studies of this nature -- '\*agriculture', 'forestry and fisheries', "**mining**", etc., in the case of industry, 'executive, administrative, and managerial', '@professional specialties', etc., in the case of occupation. These categories are shown in the left-hand column of Exhibits 8 through 11, in which the findings associated with this portion of the study are summarized. In each of these exhibits, the following is shown:

- a. The number of vital record/NMIHS comparisons made, i.e., the number of records whose ID numbers matched, grouped according to the generic category reported in the NMIHS.
- b. The number of exact and near matches respectively.
- c. The percentage distribution of vital record entries, subdivided as follows:
  - (1) Same category. - Exact and near matches combined.
  - (2) Different category. - The vital record category did **not** match that in the NMIHS.
  - (3) Homemaker. - No match possible: mother was classified as a homemaker, a category which does not appear in the NMIHS coding system (see further discussion, p. 48).
  - (4) Other. - Persons reported to be disabled, unemployed (not including homemakers), volunteers, or students.
  - (5) Vital record entry omitted or too vague to be coded.

EXHIBIT 8. NOTHRR'S INDUSTRY, NHIHS VS. VITAL RECORD

Industrial Category in Which Mother's NHIHS Code Falls	No. of Vital Records to Which Compared	No. of Exact Matches	No. of Near Matches*	Percent Distribution of Vital Record Entries				
				Same Category	Different Category	Homemaker	Other**U	Entry Omitted Unclear
010-021 Agriculture	31	3	3	19%	3%	55%	16%	7%
030-031 Forestry and fisheries	1	1	0	100%	0%	0%	0%	0%
040-050 Mining	11	3	0	27%	18%	46%	0%	9%
060 Construction	25	5	0	20%	16%	44%	4%	16%
100-222 Manufacturing, nondurable goods	214	42	23	30%	13%	35%	9%	13%
230-392 Manufacturing, durable goods	169	22	19	24%	19%	31%	7%	19%
400-472 Transportation, communications, and other public utilities	130	46	8	42%	13%	32%	4%	9%
500-571 Wholesale trade	72	7	5	17%	35%	32%	6%	11%
580-691 Retail trade	676	101	48	22%	13%	47%	9%	9%
700-712 Finance, insurance, and real estate	209	96	14	53%	7%	28%	14%	11%
721-760 Business and repair services	167	17	6	14%	16%	50%	7%	14%
761-791 Personal services	173	32	2	20%	17%	50%	7%	6%
800-802 Entertainment and recreation services	28	3	1	14%	29%	43%	11%	4%
812-892 Professional and related services	700	224	99	46%	7%	30%	4%	13%
900-932 Public administration	84	14	15	35%	18%	33%	4%	11%
942 Armed forces	<del>13</del>	<del>9</del>	<del>0</del>	<del>75%</del>	0%	<del>25%</del>	0%	<del>0%</del>
ALL INDUSTRIES COMBINED	2,702	625	243	32%	13%	38%	6%	11%

\* Vital record and NHIHS codes differ but fall in the same generic category.

\*\* Includes disabled, unemployed, volunteers, and students.

EXHIBIT 9. FATHER'S INDUSTRY, NHIHS VS. VITAL RECORD

Industrial Category in Which Father's NHIHS Code Falls	No. of Vital Records to Which Compared	No. of Exact Hatches	No. of Near Hatches*	Percent Distribution of Vital Record Entries				Entry Omitted or Unclear
				Saw Category	Different Category	Homemaker	Other**	
010-021 Agriculture	94	35	15	53%	9%	0	1%	37%
030-031 Forestry and fisheries	5	1	0	20%	20%	0	0%	60%
040-050 Mining	24	12	0	50%	25%	0	0%	25%
060 Construction	435	166	0	38%	14%	0	4%	44%
100-222 Manufacturing, nondurable goods	249	57	23	32%	21%	0	2%	44%
230-392 Manufacturing, durable goods	397	50	58	27%	19%	0	2%	52%
400-472 Transportation, communications, and other public utilities	314	108	11	38%	18%	0	3%	40%
500-571 Wholesale trade	123	10	7	14%	48%	0	1%	37%
580-691 Retail trade	457	91	39	28%	21%	0	2%	49%
700-712 Finance, insurance, and real estate	125	57	2	47%	16%	0	1%	36%
721-760 Business and repair services	223	42	10	23%	23%	0	2%	52%
761-791 Personal services	54	13	0	24%	24%	0	4%	48%
800-802 Entertainment and recreation services	38	8	2	26%	29%	0	3%	42%
812-892 Professional and related services	303	102	39	47%	16%	0	1%	37%
900-932 Public administration	116	42	6	41%	24%	0	0%	35%
942 Armed forces	<u>101</u>	64	<u>0</u>	<u>63%</u>	<u>12%</u>	<u>0</u>	1%	<u>24%</u>
AU INDUSTRIES COMBINED	3,058	858	212	35%	20%	0	2%	43%

\* Vital record and NHIHS codes differ but fall in the same generic category.

\*\* Includes disabled, unemployed, volunteers, and students.

EXHIBIT 10. MOTHER'S OCCUPATION, NMHS VS. VITAL RECORD

Occupational Category in Which Mother's NMHS Code Falls	No. of Vital Records to Which Compared	No. of Exact Hatches	No. of Near Hatches*	Percent Distribution of Vital Record Entries				
				Same Category	Different Catearv	Homenaker	Other**	Entry Omitted or Unclear
003-037 Executive, administrative, and managerial	171	39	28	39%	21%	29%	4%	6%
044-199 Professional specialties	280	97	73	61%	10%	21%	3%	5%
203-235 Technicians and related support	70	22	3	36%	31%	27%	3%	3%
243-285 Sales	451	48	46	21%	16%	45%	15%	3%
303-389 Administrative support	718	187	139	45%	16%	31%	5%	3%
403-407 Private household occupations	28	0	0	0%	11%	57%	21%	11%
413-427 Protective service	19	2	1	16%	26%	53%	0%	5%
433-469 Service, except protective and household	557	103	40	26%	9%	48%	12%	5%
473-499 Farming, forestry, and fishing	31	5	1	19%	3%	61%	13%	3%
503-699 Precision production, craft and repair	62	4	1	8%	37%	40%	8%	6%
703-799 Machine operators, assemblers, and operators	223	32	31	28%	13%	38%	11%	10%
803-859 Transportation and material moving	16	4	0	25%	19%	50%	6%	0%
869-889 Handlers, equipment cleaners, helpers, and laborers	67	3	3	9%	25%	48%	13%	5%
905 Military	<u>11</u>	5	<u>0</u>	<u>45%</u>	<u>18%</u>	<u>27%</u>	<u>0%</u>	<u>9%</u>
ALL OCCUPATIONS COMBINED	2,704	551	366	34%	15%	38%	9%	5%

\* Vital record and NMHS codes differ but fall in the same generic category.

\*\* Includes disabled, unemployed, volunteers, and students.

EXHIBIT 11. FATHER'S OCCUPATION, **NIHS** VS. VITAL RECORD

Occupational Category in Which Father's <b>NIHS</b> Code Falls	No. of Vital Records to Which Compared	No. of Exact Matches	No. of Near Matches*	Percent Distribution of Vital Record Entries				
				Same Category	Different Category	Homemaker	Other**	Entry Omitted or Unclear
003-037 Executive, administrative, and managerial	215	75	34	51%	28%	0	1%	20%
044-199 Professional specialties	266	97	12	64%	15%	0	2%	19%
203-235 Technicians and related support	80	28	6	43%	40%	0	1%	16%
243-285 Sales	235	40	50	38%	35%	0	2%	25%
303-389 Administrative support	168	30	23	32%	27%	0	4%	31%
403-407 Private household occupations	0	0	0	-	-	-	-	-
413-427 Protective service	107	43	7	47%	16%	0	3%	32%
433-469 Service, except protective and household,	286	45	21	23%	22%	0	3%	52%
473-499 Farming, forestry, and fishing	122	42	18	49%	18%	0	1%	32%
503-699 Precision production, craft and repair	627	138	81	34%	28%	0	2%	35%
703-799 Machine operators, assemblers, and operators	279	46	29	27%	24%	0	4%	45%
803-859 Transportation and material moving	264	64	16	30%	23%	0	2%	45%
869-889 Handlers, equipment cleaners, helpers, and laborers	312	38	18	18%	23%	0	6%	53%
905 Military	100	53	0	53%	22%	0	3%	22%
ALL OCCUPATIONS COMBINED	3,061	739	375	36%	25%	0	3%	36%

\* Vital record and **NIHS** codes differ but fall in the same generic category.

\*\* Includes disabled, unemployed, volunteers, and students.

The findings presented in Exhibits 8 through 11 are briefly summarized below:

1. Match rate. - Roughly one-third of the cases resulted in either exact or near matches (see table below). **Two** additional points of note: (a) the overall match rate varied hardly at all between mothers and fathers, and between industry and occupation, (b) exact matches tended to outnumber near matches, particularly in the case of industry:

<u>Variable</u>		<u>Exact Matches</u>	<u>Near Matches</u>	<u>Overall Match Rate</u>
Industry:	Mother	23%	9%	32%
	Father	28%	7%	35%
Occupation:	Mother	20%	14%	34%
	Father	24%	12%	36%

2. Variations by industry and occupation. - As one might expect, not all industries and occupations showed the same propensity for matching:
  - a. Among industries, for both mother and father, "finance, insurance, and real estate", "**professional** and related services", and "**armed** forces" had higher-than-average match rates. The match rates for '@wholesale **trade**", "business and repair services", "personal services", and "entertainment and recreation **services**" tended to be low.
  - b. Among occupations, "professional specialties" and "**military**" ranked high in terms of match rate for both mothers and fathers: "handlers, equipment cleaners, helpers, and laborers" ranked low. Some occupations ("protective **service**", "farming, forestry, and fishing", and "precision production, craft, and repair") ranked significantly higher for fathers than mothers.

3. Reasons for mismatch. - While a substantial percentage of mismatches took place simply because the vital record and NMIHS reported two fundamentally different industries (or occupations), most mismatches occurred for one of two reasons:
  - a. Homemakers. - In the case of mothers, over half of the mismatches occurred because the mother was defined in the vital record as a homemaker, a designation for which there is no code in either the Industrial or Occupational Classification Systems used in the NMIHS. For both industry and occupation (Exhibits 8 and 10), homemakers accounted for 38% of all cases involving the moth&.
  - b. Missing and/or vague entries for fathers. - In the case of the father, over half of the mismatches resulted because the vital record lacked a suitable, codable entry. The absence of this information accounted for 43% of all cases involving father's industry (Exhibit 9) and 36% of those involving occupation (Exhibit 11).

There has been some conjecture that the match rate for industry and occupation might depend on how the question concerning these data elements was worded. Some states ask simply for "industry" and "occupation" with no further qualification. Some insert the word "usual", others "most recent", and still others such phrases as "over the past twelve months" or "usual during the past year". Among the states studied, there were no less than five such variations. Interstate comparisons of discrepancy rate based on differences in wording are believed to be pointless because of (a) the relatively small number of states (and in some cases, records) in each such group and (b) the likelihood that any differences noted could not safely be ascribed to differences in wording -- there are too many other potential explanatory variables involved and too few cases to control them all.

**Imputation.** - Industry and occupation, even more than weight gain, often involves the use of imputed values. In the case of mother's pregravid and/or predelivery weight, roughly eight percent of the values in the NMIHS mother's file were imputed; for industry and occupation, the rates are even higher:

		Total number of matched records	<u>Records imputed</u> <u>Number</u> <u>Percent</u>	
Mother:	Industry	2,717	235	8.7%
	occupation	2,715	235	8.7%
Father:	Industry	3,072	470	15.3%
	Occupation	3,058	467	15.3%

As expected, where either industry or occupation is imputed, the match rate declines precipitously: both near and exact matches are virtually non-existent:

<u>Variable</u>		<u>Exact matches</u>	<u>Near matches</u>	<u>Overall match rate</u>
Mother:	Industry - imputed	<b>0.9%</b>	3.0%	3.8%
	not imputed	24.8%	9.9%	34.7%
	Occupation - imputed	<b>0.0%</b>	3.0%	3.0%
	not imputed	22.2%	14.5%	36.7%
Father:	Industry - imputed	1.3%	0.6%	1.9%
	not imputed	30.4%	10.4%	40.8%
	Occupation - imputed	<b>0.9%</b>	1.5%	2.4%
	not imputed	28.3%	14.2%	42.5%

These rates, it must be noted, are expressed as a percentage of **all** cases, including those where the vital record contained no entry or the entry was too vague to be coded. If all such cases were to be eliminated from the computation, the "**adjusted**" rates would appear as follows:

Variable	Exact matches	Near matches	Overall match rate
Mother's industry - imputed	0.9%	3.2%	4.1%
not imputed	28.2%	11.3%	39.4%
Mother's occupation - imputed	0.0%	3.1%	3.1%
not imputed	23.4%	15.2%	38.6%
Father's industry - imputed	5.3%	2.7%	8.0%
not imputed	48.5%	16.6%	65.1%
Father's occupation - imputed	3.0%	5.2%	8.2%
not imputed	37.9%	19.1%	57.0%

Adjusting the match rate in this manner **"improves"** the match rate for fathers much more than it does for mothers but leaves unchanged the basic observation noted on the preceding page: where either industry or occupation is imputed, the match rate is quite low. Since over 8% of the mothers and over 15% of the fathers in the NMIHS study sample were characterized by imputed values for industry and occupation, this can be of serious consequence in any future research that focuses on the characteristics of individual cases rather than on statistical aggregates.

A final point: industry and occupation do not appear on the U.S. Standard Certificate of Live Birth. A consequent lack of familiarity with these items may account, understandably, for at least some of the discrepancies noted in this section. The bulk of the discrepancies, however, are believed to lie in the three areas identified earlier:

- a. The lack, in 1988, of an explicit NMIHS code for homemakers.
- b. Inadequate information on the fathers.
- c. Imputation in individual cases.

## 4. UNDERLYING CAUSE OF FETAL DEATH

### 4.1 Coding Rules

The U.S. Standard Report of Fetal Death includes space for listing up to three "fetal or maternal conditions directly causing fetal **death**". These are to be listed in the following order:

- o Immediate cause
- o First antecedent cause (condition that gave rise to the immediate cause)
- o Second antecedent cause

This information is listed in Part I of the cause-of-death section of the fetal death report. In addition, Part II lists "**other** significant conditions of fetus or mother contributing to fetal death but not resulting in the underlying cause given in Part I".

Experience has shown that while most fetal death reports are properly completed, some are not. For example:

- a. Immediate and underlying causes are sometimes reversed. Example: the immediate cause is reported to be "**placenta previa**" and the first preceding cause "**fetal anoxia**".
- b. Some causes are described simply as "**fetal demise**", "**prenatal death**", or "**stillborn**". While such nomenclature is in many instances **codable** under ICD-9 -- "**still birth**", for example, is classifiable under 779.9, Unspecified condition originating in the perinatal period -- statements of this nature add nothing to the researcher's knowledge concerning either the underlying or immediate cause of death.

JWK was assigned the task in this portion of the study of reviewing the fetal death reports submitted by the various states and determining, in each case, the underlying cause of death. This was to be done in accordance with prescribed coding rules issued by NCHS.<sup>8</sup> In keeping with the client's wishes, the nosologist assigned to this task was instructed not to "second guess" the person who had prepared the original report by making use of information contained elsewhere in the record such as fetal weight, gestational age, etc. Only information reported directly in the cause-of-death section was to be used.

The coding procedures applicable to this task appear in the JWK document, Evaluation of Fetal Death Records: Keying and Coding Procedures -- Death (Components 2 and 4), dated October 19, 1990. These procedures are based on both the instructions developed by Dr. MacDorman (see footnote 8) and the more generic coding rules set forth in NCHS Instruction Manual Part 2A: Instructions for Classifying the Underlying Cause of Death, 1988. Although the latter rules (thirteen in all) are too lengthy for inclusion in this report, the first rule -- termed the General Rule -- is worth highlighting:

General Rule. - Select the condition entered on the lowest used line of Part I (of the cause-of-death section) unless it is highly unlikely that this condition could have given rise to all of the conditions listed above it.

Several examples of the application of this rule are presented below:

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<sup>8</sup> See, for example, "Coding Cause of Fetal Death", written by Harian MacDorman, Ph.D., Statistician, Mortality Statistics Branch, NCHS Hyattsville. Dr. MacDorman's instructions are appended to a cover letter by Ronald F. Chamblee, Chief, Technical Services Branch, Division of Vital Statistics, NCHS Research Triangle Park, directing that they be used to code the cause of fetal death starting in data year 1990.

Example No. 1:

- a. Cord accident
- b. Short cord syndrome

Code to 762.6 (other and unspecified conditions of umbilical cord).

Example No. 2:

- a. Cardiopulmonary failure (fetal)
- b. Severe abruptio placenta

Code to 762.1 (abruptio placentae).

Example No. 3:

- a. Umbilical cord accident
- b. Gestational diabetes (maternal)

Since diabetes could not have caused the cord accident, code to 762.6 (other and unspecified conditions of umbilical cord).

In Examples 1 and 2, the condition on the lowest line was selected since it clearly led to the condition above it. In Example 3, there was no such connection and the first-listed condition, rather than the second, was selected.

The file of underlying causes resulting from application of these rules was completed in July 1991, quality checked, and delivered to NCHS in diskette form with an accompanying file layout. The file contained a total of 4,550 records. Each record included either an ICD-9 code indicating the underlying cause of death as judged by the **JWK** nosologist, or a flag indicating that the underlying cause

could not be determined. The latter group of entries -- those for which no code could be determined -- are discussed in the section which follows (Section 4.2).

In all, there were 3,022 cases in which a specific ICD-9 code could be assigned based on the information reported. A clear majority of those cases (1,777, or 58.8%) involved complications of the placenta, cord, or membranes (code 762.X). The major items within this category were, in descending order of frequency, as follows:

762.5	Compression of umbilical cord other than cord prolapse	<b>601 cases</b> (19.9%)
762.1	Placental separation and hemorrhage other than placenta previa	479 cases (15.9%)
762.6	Other and unspecified conditions of umbilical cord	337 cases (11.2%)
762.2	Other and unspecified abnormalities of placenta	248 cases (8.2%)
--	All other items <b>codable</b> to 762.X	112 cases (3.7%)

The remaining 1,245 **codable** items were divided as follows:

760.0	Maternal hypertensive disorders	184 cases (6.1%)
768.0	Asphyxia or anoxia before onset of labor	170 cases (5.6%)
765.X	Disorders relating to short gestation and unspecified low birthweight	107 cases (3.5%)
740.0	Anencephalus	71cases (2.3%)
759.7	Multiple congenital anomalies	56 cases (1.9%)
775.0	Maternal diabetes mellitus	55 cases (1.8%)
758.X	Chromosomal anomalies	51cases (1.7%)
--	All other items involving assignable ICD-9 codes	551cases (18.2%)

#### 4.2 Quality and Completeness of the Vital Record

Of the 4,550 fetal death reports reviewed in this component of the study, roughly one-third (1,528) were indeterminate -- contained no information which would permit a **clearcut** judgment to be reached concerning the underlying cause of death. In all of these cases, either:

- a. the cause-of-death section was left completely blank,
- b. the cause was stated to be "**unknown**", or
- c. the cause was expressed in vague, non-specific terms ("fetal **demise**", "**still birth**", etc.).

The relative frequencies with which these events took place, summed over all states, were as follows:

Cause missing	54 cases	(1.2%) <sup>9</sup>
Cause unknown	710 cases	(15.6%)
Cause vague or uninformative	764 cases	(16.8%)
Total	1,528 cases	(33.6%)

Assuming that the only reason the cause-of-death section was left blank was that the person preparing the report simply "**didn't** know", what all of these cases would appear to have in common is uncertainty on the part of the preparer as to the underlying cause of death. All such cases were coded (by JWK) 779.9, Unspecified condition originating in the perinatal period, thereby satisfying the contractual requirement **but** providing no useful information for researchers.

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<sup>9</sup> Thirty-five of these cases occurred in one state. Excluding the outlying state, the percentage of cases of this nature is reduced to 0.4%.

Not all states displayed the same reporting profile, either overall or in terms of the foregoing three-way split. Among states that submitted large numbers of fetal death reports (at least **100**), the following variations were noted:

	Percentage Distribution of <u>Indeterminate Cases</u>			<u>Total</u>
	<u>Cause Missing</u>	<u>Cause Unknown</u>	<u>Cause Vague or Uninformative</u>	
State A	<b>0%</b>	11%	7%	18%
State B	0%	6%	16%	22%
State C	0%	24%	6%	30%
State D	0%	29%	3%	32%
State E	0%	14%	30%	45%
State F	0%	29%	20%	49%
State G	11%	23%	23%	57%
State H	0%	11%	59%	69%

These variations speak more, it is believed, to differences among reporting personnel and/or reporting policy than to differences in types of fetal death. No analysis was performed to support this conjecture.

Most states (35 of the 43 studied) had indeterminacy rates between 20 and 50 percent. Of these, seventeen had rates between 20 and 30 percent, thirteen between 30 and 40 percent, and five between 40 and 50 percent. The remaining eight states were evenly divided: four were less than 20 percent and four were greater than fifty. The median rate for all 43 states was 30 percent, close to the mean of 33.6 percent noted on the preceding page.

## 5. MULTIPLE CAUSES OF DEATH

### 5.1 Joint Distribution of Causes

Over 90% of the first-listed causes of death in the fetal death reports fell into one of seven categories. These categories are shown below, together with their frequency of occurrence and, where applicable, their associated ICD-9 code:

	<u>No.</u>	<u>Pct.</u>
Complications of cord, placenta, and membranes (762.X)	998	21.9%
Hypoxia/asphyxia (768.X)	750	16.5%
Other specified conditions originating in prenatal period (779.8)	245	5.4%
Extreme immaturity/preterm (765.X)	108	2.4%
Anencephalus (740.0)	53	1.2%
Cause expressly stated to be unknown	886	<b>19.5%*</b>
Cause vague or uninformative (e.g., " <b>fetal demise</b> ")	1,096	<b>24.1%*</b>
Subtotals	4,136	90.9%
No first-listed cause	63	<b>1.4%*</b>
Everything else	351	7.7%

\* NOTE: These percentages were later reduced to **15.6%**, **16.8%**, and 1.2% respectively -- the percentages shown on page 55 -- through additional information furnished by the **second-** and third-listed causes of death.

As implied in the footnote to the preceding table, the second- and third-listed causes of death often provided valuable basic or clarifying information. There were, in all, 1,652 records in which two causes were listed and 656 in which there were three. Where

two causes were reported, the one that was listed second was judged to be the underlying cause by the **JWK** nosologist 68% of the time, as opposed to 32% for the one that was listed first. Where three causes were listed, the one that was listed third was judged to be the underlying cause 49% of the time, as opposed to 33% for the one that was listed second and 19% for the one that was listed **first**.<sup>10</sup>

The joint distribution of **first-** and second-listed causes of fetal death is shown in Exhibit 12. Highlights of the exhibit are as follows:

1. The single most common combination of causes (365 cases out of a total of 1,652, or 22%) involved ICD-9 code 768.X ("hypoxia/asphyxia") as the first-listed cause and 762.X ("**complications** of cord, placenta, and membranes") as the second.
2. The next most common combination involved the following sequence: a non-specific cause (such as "**fetal** demise") listed first, followed by a statement that the underlying cause was "**unknown**". There were 233 such cases (14% of the total).
3. The third most common combination involved a non-specific cause followed by an explicit reference to complications of the cord, placenta, or membranes, **codable** to 762.X. There were 134 such cases (8% of the total).

These three combinations alone accounted for 44% of all fetal death reports involving exactly two reported causes. Other combinations of note include 77 records (5% of the total) in which a cause **codable** to 762.X was followed by another cause **codable** to the same series.

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<sup>10</sup> Percentages don't sum to 100% because of rounding.

EXHIBIT 12.  
JOINT DISTRIBUTION OF FIRST- AND SECOND-LISTED  
CAUSES OF FETAL DEATH

First-Listed Cause	Number of Cases	Distribution of Second-Listed Causes*							
		762.X	768.X	779.8	765.X	740.0	Stated to be unknown	Vague/uninformative	Everything else
762.X Complications of cord, placenta, and membranes	264	77	11	0	6	0	44	8	118
768.X Hypoxia/asphyxia	466	365	3	1	6	4	45	2	40
779.8 Other specified conditions originating in prenatal period	126	55	3	0	6	5	20	6	31
765.X Extreme immaturity/preterm	44	10	2	0	1	0	9	6	16
740.0 Anencephalus	8	1	2	0	0	0	1	1	3
cause stated to be unknown	156	28	3	0	1	0	44	46	34
Cause vague or uninformative	478	134	13	0	15	7	233	7	69
Everything else	<u>110</u>	<u>29</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>2</u>	<u>15</u>	<u>4</u>	<u>51</u>
Totals	1,652	699	39	4	39	18	411	80	362
Percent	100.0	42.3	2.4	0.2	2.4	1.1	24.9	4.8	21.9

\* Includes only those cases in which exactly two causes were reported.

Considering only those reports that listed exactly two causes of death (Exhibit 12), complications of the cord, placenta, and membranes are seen to account for only 16% of all first-listed causes but 42% of those that were listed second. The emphasis would appear to flow in the right direction -- cord accidents, etc., are more properly the underlying (second-listed) rather than immediate (first-listed) cause of death. The emphasis in the case of hypoxia/asphyxia, on the other hand, flows in the reverse direction: it was first-listed 28% of the time and second-listed only 2.4%. Again, the relative emphasis seems to be correct. Comparable percentages for the other causes listed in Exhibit 12 are as follows:

	Percentage of times the indicated cause was	
	<u>First-Listed</u>	<u>Second-Listed</u>
Other specified conditions originating in prenatal period	7.6%	0.2%
Extreme <b>immaturity/preterm</b>	2.7%	2.4%
Anencephalus	0.5%	1.1%
Cause stated to be unknown	9.4%	24.9%
Cause vague or uninformative	28.9%	4.8%

The major insights gathered from this presentation are that:

- a. Persons preparing fetal death reports are more **apt to** use the term "**unknown**" when describing the underlying cause, although it is commonly used to describe the immediate cause as well.
- b. Vague or uninformative terms are more commonly used to describe the immediate cause of death **than the** underlying cause.

## 5.2 Relationship Between Cause-of-Death and Checkbox Sections

The analysis that follows, proposed by **Marian** MacDorman of NCHS, examines the connection between items noted in the cause-of-death and **checkbox** sections of the fetal death report. The basic issue is this: when a given item (medical condition) for which a standard **checkbox** exists is listed as a cause of fetal death, was the corresponding **checkbox** marked as well? A less relevant but nonetheless interesting issue refers to the obverse: when a given item, a possible cause of death, is noted in the **checkbox** section of the report, was it noted in the cause-of-death section as well?

The results of this investigation, summed over all fetal death reports received from **checkbox** states, are presented in Exhibit 13. The medical conditions listed in the table are those defined to be of interest by Dr. MacDorman. For each condition, the following information is shown:

- a. The number of times the item in question was listed as a cause of death in the cause-of-death section.
- b. The number of times the given item was noted (received a positive checkmark) in the **checkbox** section.
- c. The junction of a and b, i.e., the number of times the given item appeared in both sections of the same report.
- d. The percentage of times, considering only those cases in which the item was listed as a cause of death, that it appeared in the **checkbox** section as well.
- e. The percentage of times, considering only those cases in which the item was checkmarked in the **checkbox** section, that it was listed as a cause of death.

EXHIBIT 13.  
CORRESPONDENCE BETWEEN CAUSES OF DEATH AND **CHECKBOX** ITEMS

	Number of Times <del>This Item</del> Was			Percentage of Joint Mentions	
	Listed as a cause of death	Marked as a checkbox	Reported in <del>both</del> sections	Given the item was listed as a cause of death	Given <del>the item</del> was marked as a checkbox
<b><u>MEDICAL RISK FACTORS</u></b>					
Belaapsia	34	11	6	18%	55%
<b><u>COMPLICATIONS OF LABOR AND/OR DELIVERY</u></b>					
Abruptio placenta	117	81	63	54%	78%
Placenta previa	1	4	1	<b>100%*</b>	25%
Cord prolapse	7	19	3	43%	16%
<b><u>METHOD OF DELIVERY</u></b>					
Hysterotomy/-ectomy	3	1		<b>0%</b>	<b>0%*</b>
<b><u>CONGENITAL ANOMALIES</u></b>					
Anencephalus	12	12		42%	42%
Hydrocephalus	3	6		33%	17%
Omphalocele/gastroschisis	2	12		50%	8%
Selected others (spina bifida, renal agenesis, Down's syndrome, <del>other chromosomal</del> anomalies)	10	4		10%	25%

---

\* Only one case reported.

The numbers and percentages shown in Exhibit 13 should be treated with caution since they are based on unweighted counts, in some cases quite small, not conducive to generalizability. Despite this caveat, some important insights are believed to be imbedded in this material. They are discussed, by condition, below:

#### Medical Risk Factors

- o **Eclampsia.** - Although a fairly common cause of death (34 mentions in all), this condition was only infrequently marked as a **checkbox** item (total of eleven mentions). On only six of those occasions did the item appear in both locations, which means that (a) 28 times out of 34 it was reported as a cause of death but not as a **checkbox** item, and (b) 5 times out of 11 it appeared as a **checkbox** item but not as a cause of death. The latter phenomenon does not necessarily constitute a reporting problem (checkbox items do not necessarily equate to causes of death) but the former phenomenon does. It implies that in this first year of **checkbox** implementation, the reported frequency of eclampsia, based on **checkbox** reporting alone, may be somewhat understated: only 18% of the times **that this** condition appeared as a cause of death was it marked in the **checkbox** section as well.

#### Complications of Labor and/or Delivery

- o **Abruptio placenta.** - As in the case of eclampsia, this condition was more commonly reported as a cause of death than as a **checkbox** item. Again, there appears to be some degree of **checkbox** underreporting: only about half of the times that the item appeared as a cause of death (63 records out of 117) was it marked in the **checkbox** section as well.
- o **Placenta previa.** - Only one state reported this condition -- four times as a **checkbox** item, once as a cause of death -- a

surprising finding in and of itself. On the single occasion in which placenta previa was a reported cause of death, it was marked as a **checkbox** item as well. The small numbers involved, however, make this observation less than overwhelming.

- 0 Cord prolapse. - Unlike eclampsia and placenta previa, cord prolapse is more commonly a **checkbox** item than a cause of death. Of the seven times it was listed as a cause of death, on three occasions it was marked in the **checkbox** section as well, a joint appearance rate of 43%.

#### Method of Delivery

- 0 Hysterectomy/-otomy. - One state reported a hysterectomy or hysterotomy as the cause of death on three occasions. The item does not appear, however, on the modified **checkbox** form used in that jurisdiction, which accounts for its lack of mention as a **checkbox** item. In another state, it appeared once as a **checkbox** item but not as a reported cause of death. Again, these numbers are too small to be generalized.

#### Congenital Anomalies

- 0 Anencephalus. - Of the twelve times this item was listed as a cause of death, only five times was it marked as a **checkbox** item, a joint appearance rate of 42%. The same situation holds in reverse: five of the twelve times it appeared as a **checkbox** item it was listed as a cause of death.
- 0 Hydrocephalus. - Hydrocephalus is more commonly a **checkbox** item than a cause of death. Of the three times it was listed as a cause of death, only once was it marked in the **checkbox** section.

- o Omphalocele/gastroschisis. - Like hydrocephalus, these conditions are more commonly reported as **checkbox** items than as a cause of death. They appeared in the cause-of-death section only twice and on one of those occasions in the **checkbox** section as well.
  
- o Selected other conditions. - Because of the relatively small numbers of occurrences involved, the remaining conditions identified by Dr. **MacDorman** (**spina** bifida, renal agenesis, Down's syndrome, and other chromosomal anomalies) were combined. Viewed in the aggregate, these conditions were more commonly reported as causes of death than as **checkbox** items. Of the ten times one of these conditions was listed as a cause of death, only once did it find its way into the **checkbox** section. Since anomalies of this nature often occur in the absence of fetal death, one suspects the level of **checkbox** underreporting may be even greater than the low joint appearance rate of 10% would imply.

It should be noted in closing that 1988 was the first year of **checkbox** implementation. As noted earlier, any underreporting which may have taken place that year is understandable and may well have been corrected by now. The findings presented above are not intended to be critical but simply to highlight a potential reporting problem which may (although it may no longer) warrant attention.

APPENDIX A.

TWO-WAY DISTRIBUTION OF NMIHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF ALCOHOL, BY STATE

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
AL/L	0	202	202	1	0	0	0	0
AL/L	1 - < 1	12	12	2	0	0	0	0
AL/L	3 - - 2	1	1	0	0	0	0	0
AL/L	5			0	0	0	0	0
AL/L	6 - 8	0	0	0	0	0	0	0
AL/L	9 - 13	1	1	0	0	0	0	0
AL/L	14 - 20	0	0	0	0	0	0	0
AL/F	0	83	83	0	0	0	0	0
AL/F	< 1	7	7	0	0	0	0	0
AL/F	1 - 2	0	0	0	0	0	0	0
AL/F	5	1	1	0	0	0	0	0
AL/F	9 - 13	0	0	0	0	0	0	0
AL/F	14 - 20	1	1	0	0	0	0	0

NMIHS ALCOHOL

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
CT/L	1 - < 1	11	11	0	0	0	0	0
CT/L	3 - - 2	0	0	0	0	0	0	0
CT/L	5	0	0	0	0	0	0	0
CT/L	6 - 8	0	0	0	0	0	0	0
CT/L	9	0	0	0	0	0	0	0
CT/L	14 - 20	0	0	0	0	0	0	0
CT/F	0	12	12	0	0	0	0	0
CT/F	< 1	2	2	0	0	0	0	0
CT/F	1 - 2	2	0	0	0	0	0	0
CT/F	3 - 5	0	0	0	0	0	0	0
CT/F	6 - 8	0	0	0	0	0	0	0
CT/F	9 - 13	0	0	0	0	0	0	0
CT/F	14 - 20	0	0	0	0	0	0	0

NMIHS ALCOHOL

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
HI/L	0	23	23	0	0	0	0	0
HI/L	< 1	3	3	0	0	0	0	0
HI/L	1 - 2	1	1	0	0	0	0	0
HI/L	3 - 5	0	1	0	0	0	0	0
HI/L	9 - 8	0	0	0	0	0	0	0
HI/L	14 - 13	0	0	0	0	0	0	0
HI/L	- 20	1	1	0	0	0	0	0

NOTE: L denotes live birth.  
F denotes fetal death.

TWO-WAY DISTRIBUTION OF NMIHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF ALCOHOL, BY STATE (CONTINUED)

**NMIHS ALCOHOL**

state/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES						
			0	1-2	3-5	6-8	9-13	14-20	
IN/L				0			3		
IN/L	1 - < 12	73	70	0	0	0	0	0	0
IN/L	3 - 5	0	0	0	0	0	0	0	0
IN/L	6 - 8	0	0	0	0	0	0	0	0
IN/L	9 - 13	0	0	0	0	0	0	0	0
IN/L	14 - 20	75	75	0	0	0	0	0	0
IN/F	1 - < 1	6	6	0	0	0	0	0	0
IN/F	3 - 2	1	1	0	0	0	0	0	0
IN/F		2	2	0	0	0	0	0	0
IN/F	- 5 8	2	0	0	0	0	0	0	0
IN/F	6	1	0	0	1	0	0	0	0
IN/F	14 - 20	0	0	0	0	0	0	0	0

**NMIHS ALCOHOL**

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES						
			0	1-2	3-5	6-8	9-13	14-20	
KS/F	0	14	14	0	0	0	0	0	0
KS/F	< 1	7	7	0	0	0	0	0	0
KS/F		0	0	0	0	0	0	0	0
KS/F	1 - 2	0	0	0	0	0	0	0	0
KS/F	3 - 5	0	0	0	0	0	0	0	0
KS/F	6 - 10	0	0	0	0	0	0	0	0
KS/F	14 - 20	0	0	0	0	0	0	0	0

**NMIHS ALCOHOL**

state/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES						
			0	1-2	3-5	6-8	9-13	14-20	
KY/L	0	108	106	1	1	0	0	0	0
KY/L	1- < 2	16	15	0	0	0	0	0	0
KY/L	3 - 5	0	0	0	0	0	0	0	0
KY/L	6 - 8	0	0	0	0	0	0	0	0
KY/L	9 - 13	0	0	0	0	0	0	0	0
KY/L	14 - 20	0	0	0	0	0	0	0	0

TWO-WAY DISTRIBUTION OF NMIHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF ALCOHOL, BY STATE (CONTINUED)

**NMIHS ALCOHOL**

state/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
ME/L	0	19	14	0	0	0	0	0
ME/L	1 -< 2	0	1	0	0	0	0	0
ME/L	3 - 5	0	0	0	0	0	0	0
ME/L	6 - 8	0	0	0	0	0	0	0
ME/L	9 - 13	0	0	0	0	0	0	0
ME/F	14 - 20	7	7	0	0	0	0	0
ME/F	< 1	1	1	0	0	0	0	0
ME/F	1 - 2	0	0	0	0	0	0	0
ME/F	3 -	0	0	0	0	0	0	0
ME/F	6 - 8	0	0	0	0	0	0	0
ME/F	9	0	0	0	0	0	0	0
ME/F	14 - 20	0	0	0	0	0	0	0

**NMIHS ALCOHOL**

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
NV/L	0	20	19	1	0	0	0	0
NV/L	1 -< 1	2	1	1	0	0	1	0
NV/L	3 - 2	1	1	0	0	0	0	0
NV/L	6 - :	0	0	0	0	0	0	0
NV/L	9	0	0	0	0	0	0	0
NV/L	14 - 20	0	0	0	0	0	0	0

**NMIHS ALCOHOL**

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
NH/F	0	12	12	0	0	0	0	0
NH/F	< 1	2	2	0	0	0	0	0
NH/F	3 - 5	1	1	0	0	0	0	0
NH/F	6 - 8	0	0	0	0	0	0	0
NH/F	9	0	0	0	0	0	0	0
NH/F	14 - 13 20	0	0	0	0	0	0	0

**NMIHS ALCOHOL**

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
NM/F	0	9	9	0	0	0	0	0
NM/F	< 1	0	0	0	0	0	0	0
NM/F	1 - 2	0	0	0	0	0	0	0
NM/F	3 - 5	0	0	0	0	0	0	0
NM/F	6	0	0	0	0	0	0	0
NM/F	14 9 - 13 20	0	0	0	0	0	0	0

APPENDIX A.

TWO-WAY DISTRIBUTION OF NMIHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF ALCOHOL, BY STATE (CONTINUED)

NMIHS ALCOHOL

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES					
			0	1-2	3-5	6-8	9-13	14-20
NC/L	0	283	277	3	2	1	0	0
NC/L	< 1	18	16	1	1	0	0	0
		4	3	1	0	0	0	0
NC/L	3 - 5	0	0	0	0	0	0	0
NC/L	6 - 8	2	1	1	0	0	0	0
NC/L	9 - 13	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
NC/F	14 - 20	91	91	0	0	0	0	0
NC/F	< 1	6	6	0	0	0	0	0
NC/F	3 - 5	1	1	0	0	0	0	0
NC/F	6 - 8	0	0	0	0	0	0	0
		9						
NC/F	14 - 20	0	0	0	0	0	0	0

APPENDIX B.

TWO-WAY DISTRIBUTION OF NMHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF TOBACCO, BY STATE

State/ Type	NMHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
AL/L		185	180	0	1	4	0
AL/L	1 - 2	4	3	0	0	1	0
AL/L	3 - 5			2	1	2	3
AL/L	6 - 10	12	3	0	0	4	1
AL/L	> 10	8	2	0	0	1	5
AL/F		67	66	0	0	1	0
AL/F	1 - 2	6	4	0	0	2	0
AL/F	3 - 5	3	2	0	0	1	0
AL/F	6 > 10	5	2	0	0	1	2
AL/F	> 10	9	4	0	0	0	5

NMHS TOBACCO

State/ Type	NMHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
CT/L	0	10	10	0	0	0	0
CT/L	1 - 2	0	0	0	0	0	0
CT/L	3 - 5			0	0	0	0
CT/L	6 - 10	0	0	0	0	0	0
CT/L	> 10	0		0	0	0	0
CT/F	1 - 5	12	12	0	0	0	0
CT/F	3 - 10	0	0	0	0	0	0
CT/F	6 -						0
CT/F	> 10	1	1	0	0	0	0

NMHS TOBACCO

State/ Type	NMHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
HI/L	0	1	0	0	1	1	0
HI/L	1 - 2	20	20	0	0	0	0
HI/L	3 - 5			0	0	0	0
HI/L	6 - 10	3	3	0	0	0	0
HI/L	> 10	2	1	0	0	0	1

NMHS TOBACCO

State/ Type	NMHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
IN/L	0	59	57	0	2	0	0
IN/L	1 - 2	4	1	0	0	1	0
IN/L	3 - 5	6	1	0	3	1	1
IN/L	6 - 10	13	5	0	0	1	4
IN/L	> 10	63	60	0	0	1	7
IN/F	1 - 2			0	0	1	2
IN/F	3 - 5	1	0	0	1	0	0
IN/F	6 - 10	1	1	0	1	0	1
IN/F	> 10	9	4	0	0	3	3

APPENDIX B.

TWO-WAY DISTRIBUTION OF NMIHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF TOBACCO, BY STATE (CONTINUED)

**NMIHS TOBACCO**

stat e/ Type	NMIHS VALUE	N	M - O N O F VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
KS/F	1 - 2	10	10	0	0	0	0
KS/F	3 - 5	0	0	0	0	0	0
KS/F			4	0		0	0
KS/F	6 - 10	4	1	0	0	0	0
KS/F	> 10	1			0		0

**NMIHS TOBACCO**

stat e/ Type	NMIHS VALUE	N	M - O N O F VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
KY/L	0	91	90	0	0	0	0
KY/L	1 - 2	2	0	0	1		1
KY/L	3 - 5	6	3	1	0	2	0
		12	8	0		2	
KY/b	6 > 10	16	3	0	0	4	4

**NMIHS TOBACCO**

Stat e/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
ME/L	0	19	19	0	0	0	0
			0	0	0	0	0
ME/L	3 - 5	1	1	0	0	0	0
ME/L	6 - 10	3	2	0	0	0	0
ME/L	> 10	6	6	0	0		1
ME/F	0	0	0	0	0	0	0
						0	0
ME/F	3 - 5	1	0	0	0	1	0
ME/F	6 - 10	1	0	0	0	1	0
ME/F	> 10	0	0	0	0	0	0

**NMIHS TOBACCO**

State/ Type	NMIHS VALUE	N	M - O N O F VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
NV/L	0	19	19	0	0	0	0
NV/L	2	1	1	0	0	0	0
		4	4	0	0	0	0
NV/L	3 - 10	2	1	0	1	0	0
NV/L	> 10	3	0	0	0	0	3

TWO-WAY DISTRIBUTION OF NMIHS AND VITAL RECORD VALUES  
PERTAINING TO MOTHER'S USE OF TOBACCO, BY STATE (CONTINUED)

## NMIHS TOBACCO

stat a/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
NH/F				0	0	0	0
NH/F	1 - 1	130	130	0	0	0	0
NH/F		0	0	0	0	0	0
NH/F	3 - 6 - 10 5	3	1	0	0	1	1
NH/F	> 10	0	0	0	0	0	0

## NMIHS TOBACCO

State/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
NM/F		8	8	0	0	0	0
NM/F	1 - 0 2	1	1	0	0	0	0
NM/F	3 - 5	0	0	0	0	0	0
NM/F	6 - 10	0	0	0	0	0	0
NM/F	> 10	1	1	0	0	0	0

## NMIHS TOBACCO

state/ Type	NMIHS VALUE	N	DISTRIBUTION OF VITAL RECORD VALUES				
			0	1-2	3-5	6-10	>10
NC/L	0						
NC/L	2	240	232	2	2	3	1
NC/L	1 - 5	9	5	0	1	1	2
NC/L	3 - 10	5	3	0	1	0	1
NC/L	6 - 10	18	7	0	3	3	5
NC/L	> 10	28	5	1	1	7	14
NC/F	0	83	75	0	3	4	1
NC/F	1 - 2	2	1	0	0	1	0
NC/F	3 - 5	3	1	0	0	1	1
NC/F	6 - 10	6	3	0	0	2	1
NC/F	> 10	7	1	0	1	1	4

APPENDIX C.

DIFFERENCES IN MOTHER'S WEIGHT GAIN BETWEEN NMHS AND VITAL RECORD  
AS A FUNCTION OF MOTHER'S WEIGHT PRIOR TO PREGNANCY, BY STATE

Difference in Reported Weight Gain  
(NMHS - Vital Record)

State/ Type	NMHS Weight Prior To Pregnancy	N	Difference in Reported Weight Gain (NMHS - Vital Record)						
			<- 50	-50 to -21	-20 to -6	-5 to 5	6 to 20	21 to 50	>50
AL/L	< 110	20	0%	0%	10%	45%	25%	15%	5%
AL/L	110-129	69	0%	3%	23%	42%	26%	6%	0%
AL/L	130-149	61	0%	10%	20%	33%	26%	10%	2%
AL/L	150-169	29	3%	10%	21%	38%	21%	7%	0%
AL/L	> 169	17	12%	18%	24%	24%	12%	12%	0%
AL/L	Total	196	2%	7%	20%	37%	24%	9%	1%
AL/F	< 110	10	0%	0%	10%	20%	50%	20%	0%
AL/F	110-129	19	0%	0%	16%	47%	26%	11%	0%
AL/F	130-149	15	0%	0%	33%	40%	27%	0%	0%
AL/F	150-169	8	0%	0%	38%	50%	13%	0%	0%
AL/F	> 169	11	18%	18%	0%	45%	9%	9%	0%
AL/F	Total	63	3%	3%	19%	41%	25%	8%	0%

Difference in Reported Weight Gain  
(NMHS - Vital Record)

State/ Type	NMHS Weight Prior To Pregnancy	N	Difference in Reported Weight Gain (NMHS - Vital Record)						
			<- 50	50 to -21	20 to -6	5 to 5	6 to 20	21 to 50	>50
HI/L	< 110	6	0%	0%	0%	83%	17%	0%	0%
HI/L	110-129	9	0%	11%	0%	67%	22%	0%	0%
HI/L	130-149	6	0%	0%	17%	83%	0%	0%	0%
HI/L	150-169	4	0%	0%	0%	75%	0%	0%	0%
HI/L	> 169	1	0%	0%	0%	100%	25%	0%	0%
HI/L	Total	26	0%	4%	4%	83%	15%	0%	0%

Difference in Reported Weight Gain  
(NMHS - Vital Record)

State/ Type	NMHS Weight Prior To Pregnancy	N	Difference in Reported Weight Gain (NMHS - Vital Record)						
			<- 50	-50 to -21	-20 to -6	-5 to 5	6 to 20	21 to 50	>50
IN/L	< 110	13	0%	0%	0%	0%	38%	46%	15%
IN/L	110-129	31	0%	0%	0%	0%	39%	58%	3%
IN/L	130-149	22	0%	0%	0%	9%	14%	73%	0%
IN/L	150-169	11	0%	0%	0%	9%	27%	36%	2%
IN/L	> 169	8	0%	0%	0%	0%	38%	38%	25%
IN/L	Total	85	0%	0%	0%	4%	31%	55%	11%
IN/F	< 110		0%	0%	0%	29%	43%	29%	0%
IN/F	110-129	21	0%	0%	24%	40%	20%	8%	8%
IN/F	130-149	13	0%	8%	23%	38%	15%	8%	8%
IN/F	150-169	15	0%	0%	20%	60%	13%	7%	0%
IN/F	> 169	14	7%	7%	21%	29%	29%	7%	0%
IN/F	Total	74	1%	3%	20%	41%	22%	9%	4%

APPENDIX C.

DIFFERENCES IN MOTHER'S WEIGHT GAIN BETWEEN NMIHS AND VITAL RECORD  
AS A FUNCTION OF MOTHER'S WEIGHT PRIOR TO PREGNANCY, BY STATE (CONTINUED)

**Difference in Reported Weight Gain  
(NMIHS - Vital Record)**

State/ Type	NMIHS Weight Prior To Pregnancy	N	Difference in Reported Weight Gain (NMIHS - Vital Record)						
			<- 50	50 to -21	20 to -6	5 to 5	6 to 20	21 to 50	>50
KS/F	< 110	0	***	***	***	0 **	***	***	***
KS/F	110-129	4	0%	0%	0%	100%	0%	0%	0%
KS/F	130-149	11	0%	0%	9%	45%	45%	0%	0%
KS/F	150-169	2	0%	0%	50%	0%	50%	0%	0%
KS/F	> 169	2	0%	0%	0%	50%	0%	50%	0%
KS/F	Total	19	0%	0%	11%	53%	32%	5%	0%

**Difference in Reported Weight Gain  
(NMIHS - vital Record)**

State/ Type	NMIHS Weight Prior To Pregnancy	N	Difference in Reported Weight Gain (NMIHS - vital Record)						
			<- 50	-50 to -21	-20 to -6	-5 to 5	6 to 20	21 to 50	>50
KY/L	< 110	16	0%	0%	38%	38%	13%	13%	0%
KY/L	110-129	45	0%	7%	13%	33%	24%	22%	0%
KY/L	130-149	33	3%	3%	12%	52%	9%	18%	3%
KY/L	150-169	16	0%	0%	19%	25%	38%	19%	0%
KY/L	> 169	12	0%	0%	25%	42%	17%	17%	0%
KY/L	Total	122	1%	3%	18%	39%	20%	19%	1%

**Difference in Reported Weight Gain  
(NMIHS - vital Record)**

State/ Type	NMIHS Weight Prior To Pregnancy	N	Difference in Reported Weight Gain (NMIHS - vital Record)						
			<- 50	-50 to -21	-20 to -6	-5 to 5	6 to 20	21 to 50	>50
ME/L	< 110	1	0%	0%	0%	0%	100%	0%	0%
ME/L	110-129	9	0%	0%	0%	44%	29%	0%	0%
ME/L	130-149	2	0%	0%	11%	50%	22%	11%	11%
ME/L	150-169	2	0%	0%	0%	50%	0%	50%	0%
ME/L	Total	21	0%	0%	5%	52%	29%	10%	5%
ME/F	< 110	0	***	***	***	0 **	***	***	***
ME/F	110-129	1	0%	0%	0%	0%	100%	0%	0%
ME/F	130-149	1	0%	0%	0%	100%	0%	0%	0%
ME/F	150-169	0	***	***	***	***	***	***	***
ME/F	> 169	0	***	***	***	***	***	***	***
ME/F	Total	5	0%	0%	0%	60%	40%	0%	0%

APPENDIX C.

DIFFERENCES IN MOTHER'S WEIGHT GAIN BETWEEN NMIHS AND VITAL RECORD  
AS A FUNCTION OF MOTHER'S WEIGHT PRIOR TO PREGNANCY, BY STATE (CONTINUED)

		Difference in Reported Weight Gain (NMIHS - Vital Record)										
State/ Type	NMIHS Weight Prior To Pregnancy	N	-50		-20		-5		6		21	
			<	=	<	=	<	=	<	=	<	=
			<-50	-21	-6	5	20	50	>50			
NV/L	< 110	0	***%	***%	***%	***%	***%	***%	***%	***%	***%	***%
NV/L	110-129	9	0%	0%	11%	78%	0%	11%	0%			
NV/L	130-149	8	0%	0%	0%		38%	13%	0%			
NV/L	150-169	3	0%	0%	0%	50%	0%	0%	0%			
NV/L	> 169	2	0%	0%	67%	100%	0%	33%	0%			
NV/L	Total	2	0%	0%	13%	61%	13%	13%	0%			

		Difference in Reported Weight Gain (NMIHS - Vital Record)										
State/ Type	NMIHS Weight Prior To Pregnancy	N	-50		-20		-5		6		21	
			<	=	<	=	<	=	<	=	<	=
			<-50	-21	-6	5	20	50	>50			
NH/F	< 110	2	0%	0%	0%	100%	0%	0%	0%			
NH/F	110-129	2	0%	0%	50%	50%	0%	0%	0%			
NH/F	130-149	11	0%	0%	0%	100%	0%	0%	0%			
NH/F	150-169	4	0%	0%	0%	75%	25%	0%	0%			
NH/F	Total	11	0%	0%	9%	82%	9%	0%	0%			

		Difference in Reported Weight Gain (NMIHS - Vital Record)										
State/ Type	NMIHS Weight Prior To Pregnancy	N	-50		-20		-5		6		21	
			<	=	<	=	<	=	<	=	<	=
			<-50	-21	-6	5	20	50	>50			
NY/L	< 110	27	0%	4%	22%	44%	26%	4%	0%			
NY/L	110-129	97	0%	0%	19%	44%	27%	9%	1%			
NY/L	130-149	78	0%	1%	28%	40%	21%	8%	3%			
NY/L	150-169	44	0%	9%	18%	43%	23%	7%	0%			
NY/L	> 169	33	12%	12%	15%	27%	21%	12%	0%			
NY/L	Total	279	1%	4%	21%	41%	24%	8%	1%			

APPENDIX C.

DIFFERENCES IN MOTHER'S WEIGHT GAIN BETWEEN NMIHS AND VITAL RECORD  
AS A FUNCTION OF MOTHER'S WEIGHT PRIOR TO PREGNANCY, BY STATE (CONTINUED)

		Difference in Reported Weight Gain (NMIHS - Vital Record)							
State/ Type	NMIHS Weight Prior To Pregnancy	N							>50
			<-50	50 to -21	20 to -6	5 to 5	6 to 20	21 to 50	
NYC/L	< 110	33	0%	0%	15%	52%	21%	12%	0%
NYC/L	110-129	87	0%	2%	24%	29%	20%	11%	3%
NYC/L	130-149	84	0%	10%	26%	39%	19%	12%	1%
NYC/L	150-169	41			34%	32%	17%	7%	0%
NYC/L	> 169	35	6%	9%	31%	23%	23%	6%	3%
NYC/L	Total	280	1%	6%	26%	34%	20%	10%	2%
NYC/F	< 110	31	0%	14%	57%	0%	29%	0%	0%
NYC/F	110-129		0%	6%	11%	42%	26%	13%	3%
NYC/F	130-149	19	0%	5%	33%	42%	26%	16%	0%
NYC/F	150-169	9			11%	11%	44%	0%	0%
NYC/F	> 169	8	0%	0%	25%	38%	38%	0%	0%
NYC/F	Total	74	1%	7%	18%	34%	30%	9%	1%

		Difference in Reported Weight Gain (NMIHS - vital Record)							
State/ Type	NMIHS Weight Prior To Pregnancy	N							>50
			<-50	-50 to -21	-20 to -6	-5 to 5	6 to 20	21 to 50	
NC/L	< 110	28	0%	4%	11%	71%	7%	7%	0%
NC/L	110-129	82	0%	2%	20%	62%	13%	1%	1%
NC/L	130-149	79	0%	8%	13%	49%	23%	6%	1%
NC/L	150-169	39	3%	5%	10%	38%	41%	3%	0%
NC/L	> 169		2%	9%	14%	41%	23%	11%	0%
NC/L	Total	23:	1%	6%	14%	53%	21%	5%	1%
NC/F	< 110	12	0%	6%	0%	67%	33%	0%	0%
NC/F	110-129	17	0%	0%	20%	35%	24%	12%	0%
NC/F	130-149	25						4%	0%
NC/F	150-169	17	0%	18%	24%	24%	24%	12%	0%
NC/F	> 169	13	0%	0%	46%	23%	23%	8%	0%
NC/F	Total	a4	0%	5%	23%	36%	30%	7%	0%

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