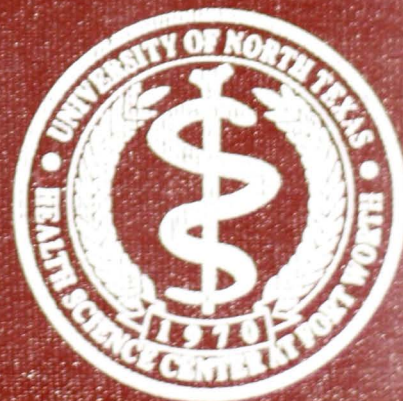




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Migala, Witold M.
Impact analysis of Texas
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Migala, Witold M., Impact Analysis of Texas Child Fatality Review Teams on Incidence and Select Cause of Death Determination. Doctor of Philosophy (Biomedical Sciences), December 2000, 136 pp., 14 tables, reference list, 107 titles.

To examine the impact of Child Fatality Review Teams (CFRT) on the overall death rates of children in Texas, those counties with CFRT representation were compared to counties without representation. Death rates for Sudden Infant Death Syndrome (SIDS) and rates for death due to abuse, classified by ICD-9 coding, were also compared marked by CFRT representation.

The Texas Department of Health's Epigram database was used to collect death rate data. Age-adjusted death rates by gender, race/ethnicity, age group and cause of death were established for the five counties with CFRTs initiated in 1992; the two counties with teams initiated in 1993; and the 56 counties with teams initiated in 1994. These were compared to the death rates of counties without CFRT representation for the same years.

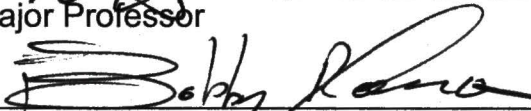
Analyses were conducted by using t-tests, chi-square, and ARIMA statistics, and calculation of odds ratios and confidence intervals. The results of the inferential tests suggest that CFRT representation had a protective effect on children's death rates contingent on the longevity of representation. Additional research regarding impact evaluation of multidisciplinary team representation on the incidence and rate of children's deaths is recommended.

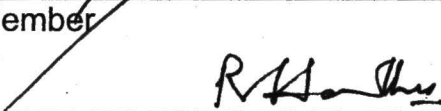
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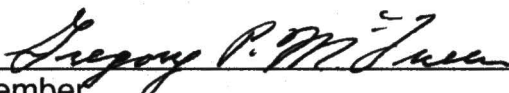
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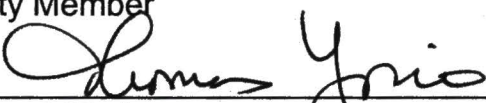

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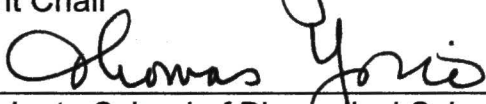

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IMPACT ANALYSIS OF TEXAS CHILD FATALITY REVIEW TEAMS
ON INCIDENCE AND SELECT CAUSE OF DEATH
DETERMINATION

DISSERTATION

Presented to the Graduate Council of the
Graduate School of Biomedical Sciences

University of North Texas

Health Science Center at Fort Worth

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Witold M. Migala, B.A., M.P.H.

Fort Worth, Texas

December 2000

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CHAPTER 1

INTRODUCTION

Monitoring and improving the health status of children are among the most important goals set forth by the US Department of Health and Human Services.¹ The United States lags behind many of its international peers in reducing child mortality.² However, due to general improvements in socioeconomic and living conditions as well as advances in medical knowledge and technology, the United States has observed a natural decline in childhood mortality over the past few years.^{3,4} The intensity of this decline is, of course, affected by purposeful interventions directed specifically at impacting injury and mortality among children. Multidisciplinary, inter-agency review teams were developed to serve as catalysts for the assimilation and dissemination of information and development of interventions to spur the decrease in the incidence of preventable death and injury to children.^{5,6}

Texas was one of the first states in the country to initiate Child Fatality Review Teams (CFRT) to review children's deaths; with its first teams becoming operative in 1992.⁷ The CFRT is a multidisciplinary team representing medical, legal, law enforcement, children's advocacy groups and other relevant organizations which meet to review deaths of children under 17 years old. It is the intent of this researcher to examine the impact of this review process on the

incidence of children's deaths. An extensive review of the literature and a national survey were conducted to provide background into the multidisciplinary team review process. Descriptive and inferential statistics were utilized to describe the relationship between those counties in Texas which have been represented by a CFRT and those which have not.

With the philosophical goal of public health directed at prevention, the design of this study can provide fundamental insight into the impact that representation by a CFRT may have on the incidence rates of children's deaths. Specifically, the intent of this research is to examine whether representation by a CFRT has a protective effect on children's death rates, thereby effectively accomplishing the preventive mission of a public health intervention. In an effort to enhance the accuracy with which this study can infer an effect attributable to the maintenance of a CFRT, analysis was pursued with both overall incidence rates as well as select causes of death. This is pursuant to the premise that effective interventions are dependent on the accuracy of the data which led to their development.^{8,9,10}

The objective of the Texas CFRT teams is to use the multidisciplinary, inter-agency team approach to review children's deaths in order to ensure accurate investigation and reporting; identify trends and remarkable issues; and ultimately impact the incidence of preventable deaths among children.¹¹ These inter-disciplinary teams are currently operative in over half the counties in Texas. However, a thorough review of the literature and investigation of other activities

related to the CFRT process indicates that no formal research has been conducted attempting to statistically associate the efforts of child fatality review teams on the incidence of death among children. It is the objective of this study to examine this association.

Purpose and Significance

Interagency child death review teams originally emerged in response to the increasing awareness of severe violence against children in the United States. The first team originated through the Department of Health Services in Los Angeles, California, in 1978 specifically to address child abuse deaths. Since then, child death review teams have been established across the nation and have expanded to include all causes of death in their review. Approximately 100 million Americans or 40% of the nation's population now live in counties or states served by such teams; most having been formed within the past decade. Multi-agency child death review involves a systematic, multidisciplinary, and multi-agency process to coordinate and integrate data and resources from coroners, law enforcement, courts, child protective services, health care providers and other professionals from the medical, social and legal arenas. This process has demonstrated the unique capabilities integral to the concept of multi-disciplinary review process, including the enhanced accuracy of data and subsequent effective generation of interventions. Theoretically, the objective of

these review teams is to promote effective multi-agency case management that results in the prevention of avoidable deaths and serious injuries to children.^{6,12-15}

In 1990 the Surgeon General released a series of health-related goals for the nation. These goals, under the heading of "Healthy People 2000: National Health Promotion and Disease Prevention Objectives," were categorized under 22 Priority Areas. One area, "Violent and Abusive Behavior," included number 7.13: "Extend to at least 45 states implementation of unexplained child death review systems." This goal was met in April of 1999. As recently as 1991, only about 30 states had some sort of child death review protocol.¹⁶ Texas was one of the first states to establish a State Child Fatality Review Committee and is now represented in 138 of its 254 counties. Establishment of these teams and justification for the growth has been driven by speculative indications that such teams fulfill the mission of preventing childhood deaths.^{11,17}

The Texas Legislature formally amended Chapter 264 of the Family Code to provide for the maintenance of local and state Child Fatality Review Teams (CFRT). The ultimate goal of the statewide project is to identify trends in order to guide intervention strategies towards reducing the overall number of preventable childhood deaths. In theory, due to the efforts of the local CFRTs, child fatalities are investigated, reviewed and recorded with improved accuracy and the prevention strategies subsequently developed ultimately result in a reduction in fatalities among children.^{11,18}

Whether the activities of the CFRT are directly responsible for decreasing death rates among children or whether the CFRT is the result of sensitivities and activities already underway, the researcher believes that the mere presence of a CFRT is representative of a measurable protective effect. The object of this study is to determine if the CFRT, for whatever reason, has a protective effect on the incidence of preventable deaths of children. Obviously, the significance of establishing such an association is that children's lives would be saved.

Statement of Problem

The CFRTs across the state and the country are still in their foundling, if not primitive, stages of development. The process for managing information assimilated by the CFRTs and subsequent development of preventive initiatives has not yet been well orchestrated. Nor is there a nationally recognized standardized procedure for the collection, analysis and dissemination of information. It is imperative to take advantage of any and all available information regarding those factors that may impact the wellbeing of children. Towards this end, a comprehensive analysis of available data is essential towards quantifying and qualifying those interventions that ultimately lead to the prevention of additional childhood deaths. The CFRT in Texas is ideal for this analytical examination since it is one of the States with the longest standing CFRTs and, unfortunately, although beneficial to the purposes of this study, has nearly an equal distribution of counties with and without CFRT representation.

This study was designed to compile and analyze the data available for deaths occurring among Texas children for the years 1985 through 1998 from a previously unexplored perspective. The study analyzed the incidence rates and select causes of death of children throughout Texas over the past fourteen years from various perspectives in order to isolate the effect of the child fatality review process. This manner of comprehensive analysis provides insight into the effect that a multidisciplinary review team has on the incidence of children's deaths and the accuracy with which these deaths are considered.

The benefit of demonstrating quantifiable support for this relationship would provide significant motivation to mandate such reviews throughout the state instead of having representation remain optional at the discretion of each local county, as is currently the case. Ultimately, it is anticipated that CFRT representation and the interventions directly and indirectly pursuant to this manner of review result in a reduction in the incidence of preventable childhood mortality.

Hypothesis

This study investigates whether the establishment and maintenance of Child Fatality Review Teams in Texas has contributed to the decrease in the incidence of childhood mortality. Two hypotheses are tested and provide differing although complementary perspectives towards establishing supporting inference in regard to the study question. These are:

- H₁: Counties represented by a Child Fatality Review Team demonstrate a decrease in the incidence rates of childhood mortality when compared to counties without representation by a review team.
- H₂: When comparing the determination of select causes of death, specifically Sudden Infant Death Syndrome and deaths due to abuse, counties represented by a Child Fatality Review Team reflect changes in the determination of these deaths when compared to the incidence of these deaths prior to or without representation by a review team.

The first hypothesis investigates whether counties represented by a Child Fatality Review Team (CFRT) demonstrate a decrease in the incidence of childhood mortality when compared to counties that have not been represented by a team. This research question assumes a broad-based approach and seeks to quantify the overall effect of a CFRT on the incidence of children's deaths in Texas since the inception of the CFRTs.

The second hypothesis compares the determination of select causes of death, specifically Sudden Infant Death Syndrome and deaths due to abuse, between counties represented by a Child Fatality Review Team. This perspective will determine whether changes in the determination of these deaths occur when compared to the incidence of these deaths prior to or without representation by a CFRT.

A complementary element of the second hypothesis will be to establish that cited differences reflect determination of cause of death as occurring with more accuracy among those counties represented by a Child Fatality Review Team. For example, deaths otherwise attributed to SIDS will have been diagnosed differently and with more accuracy and deaths initially identified as due to other causes will have been identified as child abuse as a result of the review process. The appropriateness of these hypotheses is further developed in the ensuing chapters.

Lastly, the hypotheses assume that there is no difference between the groups being compared. Differences detected through analysis will indicate whether the CFRT has an effect on children's death rates. More specifically, statistically identified differences will infer whether representation by a CFRT has a protective effect on the incidence of death among children. Determination whether this effect is due directly or indirectly as a result of CFRT representation is the primary objective of this study.

Limitations and Key Assumptions

The main assumption justifying this study is that the majority of the deaths among children are from unnatural causes and can, therefore, be prevented.¹⁹ The underlying theoretical justification of the CFRT is that multidisciplinary review of children's deaths will result in decreasing the incidence of these preventable deaths.⁷ Historically, prioritization of children's health has coincided with the

development of society. Since numerous activities will then be focused on children's health, isolation of a single variable can be somewhat elusive.^{3,4,20} It is, therefore, an assumption of this study that statistical design and analysis will effectively, although not entirely, isolate the effect of the child fatality review team on the incidence of childhood death.

Of course, a myriad of other variables will have exerted an effect on the incidence of children's deaths.²¹ A notable example of this anticipated effect is the elevated attention and enhanced scrutiny with which child abuse has been pursued as a possible cause of death in the past decade. This phenomenon has been clearly identified as a major contributor to the advent of the multidisciplinary review process itself. A significant intervening effect can also be attributable to a national movement targeting Sudden Infant Death Syndrome (SIDS) initiated in the early to mid-nineties, squarely in the midst of the study period. Local community efforts and priorities will have had a further effect on incidence of children's deaths as will the multiple variables represented by the activities of many other regional, internal and external entities.²²

It is specifically due to the possible significant contributing effect of the peripheral interventions represented by deaths due to abuse and SIDS that these two causes of death were selected for inclusion in this study. The influence of the child fatality review team on determination of cause of death is pursued with the understanding that a significant amount of research and intervention has taken place to impact the incidence of death due to both abuse and SIDS during the

study period. However, the comparative incidence rates between counties with and without CFRT representation and within counties prior to and after intervention will not have been impacted since the effect will have been shared throughout all areas under consideration. This may, however, certainly dilute some of the inference made solely on the basis of statistical analysis.

Additionally, the vehicle for accurately identifying deaths due to abuse and SIDS may very well have been the CFRT itself. Lastly, it is possible that effect of the independent interventions on behalf of abuse and SIDS may have been represented within the CFRT process. The review of the literature and the analysis of the data will be conducted with particular attention to the contribution of the independent effect of these two causes of death on the overall results.

Further limitations include the ability of various communities, based on their geographical and logistical limitations, to disseminate information or generate appropriate interventions. Contemporary knowledge and updated techniques may communicate in a qualitatively different manner across less populous areas and in differing communities. Therefore, investigation, both on an intuitive and empirical level, will take place to describe the effects of certain limitations on communication and representation depending on geographic or logistical constraints. This concern will be operative when addressing the issues raised in the preceding paragraph.

Additional limitations include the restrictions inherent in the use of a standardized database. In this study, the Texas Department of Health (TDH)

Epigram Database and standardized vital records maintained by the Texas Bureau of Vital Statistics (TBVS) were used to establish the data used for analysis. The data do not include additional qualifying information that may have been desirable in isolating particular variables. For example, family background, parental composition, income level, and other historical information was not available for this study.

A related limitation is that the data used for this study is secondary data and not collected directly by the researcher. Therefore, there is no assurance other than the reputed integrity of the sources (TDH and TBVS) in regard to the reliability of their collection and reporting procedures, although these are ostensibly conducted in accordance with generally accepted and appropriate procedures.

Lastly, a consequential limitation of this study is the ability to generalize the finding to other CFRTs and/or geographic and municipal areas. Indeed, it is one of the justifications of this study that the insinuated results of studies in other states do not necessarily indicate that similar results would be observed in the Texas population. Further, different municipalities have different priorities in the allocation of existing resources and differing abilities in the implementation and dissemination of information and interventions. This may affect the quality and indeed, frequency, of interventions and, subsequently, the impact on childhood deaths.

Overview

The researcher used mortality data from the years 1985 through 1998 collected by the Texas Department of Health and the Texas Bureau of Vital Statistics to compare the incidence rates and select causes of death among children between counties with and without representation by the child fatality review process. The researcher pursued analysis of the impact of these review teams by examining two distinct although related questions.

- 1) First, do the counties who have or are represented by a Child Fatality Review Team demonstrate a significantly decreased incidence of childhood mortality?
- 2) Second, has there been a significant change in the determination of select causes of death among those counties represented by a Child Fatality Review Team?

Substantiation of the second question infers impact on mortality incidence by establishing the enhanced accuracy of data, which drives the interventions that have been demonstrated to decrease incidence of childhood mortality. A significant affirmative finding to the first hypothesis substantiated by affirmation through the second hypothesis would provide compelling inference indicating an association between review teams and a protective influence on childhood mortality. Confirmation of such a link would promote the establishment of a system whereby all Texas counties would be represented by a Child Fatality

Review Team and thereby enhance efforts towards the prevention of childhood deaths.

CHAPTER II

BACKGROUND AND REVIEW OF RELATED LITERATURE

The use of multidisciplinary, inter-agency review teams to investigate, evaluate and develop responses to problematic issues is not a new concept. However, in regard to using these teams to review the deaths of children, the process is still in its primitive stages. A thorough review of the available literature specific to CFRTs indicated that this body of literature is not extensive. This necessitated having to contact each individual state to solicit feedback regarding the programs operative around the country and thereby solicit what amounted to be the current literature.

This was accomplished by administering a survey to all fifty states, with 27 responding, to determine whether there was some sort of CFRT process and, if so, to what extent. The survey also served as a vehicle to obtain descriptions, reports, and analysis of most of the programs around the United States. There was substantially more academic literature available in regard to the multidisciplinary process specific to abuse and SIDS deaths. As with all studies, the strengths and weaknesses of previous research efforts determined the path of this study.

The following section provides substantiation and justification for this study by reporting on the systematic review of the literature, reports and activities

related to the CFRT process throughout the country. This section is divided into four separate but complementary components. The first component describes the CFRT process on a national level primarily by providing the results of the survey and other reports on a state by state basis. The descriptions include the status and emphasis of each state's program as well as evaluation on the priority placed on SIDS, children's deaths due to abuse and statistical analysis to establish outcomes of the CFRT process. The second component of this section provides information about the CFRT process within Texas. This section also presents comparisons between the process in Texas and the rest of the United States and further establishes the need for this study. The third and fourth components provide a description of the activities related to children's deaths due to abuse and SIDS, thereby establishing support for the inclusion of these two select causes of death in this study.

Child Fatality Review - National

The Delta Constancy Group in Washington, DC sponsored a study by Onwuachi-Saunders et al. to demonstrate how child death review teams can be used to prevent future deaths through retrospective, multi-agency case analysis and to generate recommendations for educational programs and policy change. The study, published in 1999, examined all deaths to persons ages 21 years and younger in Philadelphia that occurred in 1995. The data were compiled by the Philadelphia Interdisciplinary Youth Fatality Review Team (PIYFRT), a multi-

agency, multidisciplinary, community based group created in 1993 with the mission to prevent future deaths through review, analysis, and initiation of corrective actions. Data were collected on demographic variables, as well as the circumstantial variables on injuries such as weapon type, alcohol and drug use, and contact with the criminal justice system, among others. Each case was reviewed to determine whether or not the death was preventable. Selected injury-related death cases were further analyzed by exploring demographic and circumstantial variables. The results indicated that more than a third (37.2%) of all deaths were considered preventable. Of the accidental/injury deaths, 95% were judged to be preventable. Preventable fire/burn injury deaths were associated with lack of a smoke detector, non-supervision of children, and faulty home appliances. Violent deaths were associated with substance abuse, gang involvement, chronic truancy, academic failure, and access to weapons. The conclusion of this study indicated that relevant policies for these preventable or intervene-able deaths, "such as the use of non-battery powered smoke detectors", were warranted.¹⁵

The conclusion of the Onwuachi-Saunders et al. study did not correlate the impact of the review team's intervention with the incidence of death among children as was its original specified intent. Rather, it identified those deaths considered preventable, isolated the causes and then proposed an intervention. In their supplemental response to the survey discussed later in this section, the respondent for the Pennsylvania CFRT stated:

“Although no statistical review has been attempted to correlate the teams with incidence of children’s deaths, there is probably some spill-over effect; the child death rate has decreased by 24%. However, there were no studies to scientifically or statistically demonstrate these decreases are directly related to the review process. Because a significant component of the child death review process is the investigation of the risk factors that lead to death and the development and implementation of statewide and local prevention strategies, we can assume these efforts...did have an impact on the decrease in infant and child deaths.”²³

This sort of non-empirical, non-scientific correlation was found to be a recurring assumption on the part of most of the survey respondents and underscores the need for an empirical performance outcome evaluation. Several respondents, however, indicated that this sort of evaluation was indeed forecast for their state and expressed interest in the design and result of this study.

The Onwuachi-Saunders study was one of the few studies found by the researcher specifically investigating or reviewing the effect of the child fatality review process in the United States. It is clear, though, that this sort of evaluation did not establish the association sought in this study. Due to a dearth of information, it was, therefore, necessary to contact each of the fifty states to establish the nature of CFRT activity throughout the country. This was accomplished by soliciting response to a survey and using the survey as a vehicle to obtain reports and other documentation describing the CFRT activities

in the responding states. Of the 50 states that were requested to participate, 27 or 54%, responded. Non-respondents were re-contacted to further solicit response but no further replies were received.

The survey asked the following questions:

- ◆ Does the state of (name of state) have a comprehensive child fatality review team?
- ◆ Are all counties, parishes and other geographic areas of the state represented by these teams?
- ◆ Is representation by a CFRT for all counties, parishes and other geographic areas mandated by law?
- ◆ Is the process for review standardized across the state and between teams?
- ◆ Are all children's deaths reviewed?
- ◆ Has the effect of the child death review process been statistically demonstrated to prevent children's deaths?
- ◆ Are there any publications or reports which describe the process for review and the impact since inception? If so, can a copy or information on how to obtain these reports and/or publication be forwarded?

Nearly all of the responding health departments and social services components provided additional information and documentation. The responses to the survey are summarized in the following chart:

Table 1: Survey Table: Chart of State Responses to CFRT Review Survey.

State	CFRT Review Exists?	All areas represented?	Representation mandated?	Process standardized?	All deaths reviewed?	Statistical evidence re: prevention?
Alabama	Yes	No	No	No	No	No
Alaska	Yes	No	No	Yes	No	No
California	Yes	No	No	No	No	No
Colorado	Yes	Yes	No	Yes	Yes	No
Delaware	Yes	Yes	Yes	Yes	No	No
Florida*	No	No	No	No	No	No
Georgia	Yes	Yes	Yes	Yes	No	No
Hawaii	Yes	Yes	Yes	Yes	Yes	No
Idaho	Yes	Yes	No	Yes	Yes	No
Kansas	Yes	Yes	Yes	Yes	Yes	No
Maryland	Yes	No	Yes	Yes	No	No
Massachusetts	Yes	Yes	Yes	No	No	No
Minnesota	Yes	Yes	Yes	Yes	No	No
Missouri	Yes	Yes	Yes	Yes	No	No
Montana	Yes	No	No	Yes	No	No
Nebraska	Yes	No	No	No	Yes	No
New Jersey	Yes	Yes	Yes	No	Yes	No
Oregon	Yes	Yes	Yes	Yes	No	No
Pennsylvania	Yes	No	No	Yes	Yes	No
South Dakota	Yes	No	No	No	No	No
Tennessee	Yes	Yes	Yes	Yes	Yes	No
Texas	Yes	No	No	Yes	No	No
Utah	Yes	Yes	Yes	Yes	Yes	No
Virginia	Yes	Yes	Yes	Yes	No	No
Washington	Yes	Yes	No	No	No	No
Wisconsin	Yes	Yes	Yes	Yes	Yes	No
Wyoming	Yes	No	No	Yes	No	No

Source: Research survey; references # 24-56. *Team only reviews child abuse and neglect.

Of the twenty-seven states responding to the survey, all reported having a child fatality review team except Florida where only cases of child abuse and neglect are reviewed. Sixteen states (59%) reported having representation that covers all areas of the state. Representation is mandated in fourteen (52%) of the responding states. The only state where representation is mandated that does not report all areas as being represented is Maryland. The review process is standardized in nineteen (70%) of the states, though only ten states (37%)

reported reviewing all children's deaths. Eight of the ten states that review all deaths have a standardized process. Nebraska and New Jersey are the only states having no standardized process that review all reported child fatalities. None of the states responding to the survey reported having conducted or pursuing any type of statistical or analytical evaluation or analysis supporting the preventive benefit of the child fatality review team on the incidence of children's deaths.

The only responding state not represented by a comprehensive CFRT system was Florida although, 4 out of 67 Florida counties report having a CFRT that review all children's deaths and others "are exploring developing teams that would review all child deaths."²⁴ However, as mandated by Florida Statute 383.402, the Florida Department of Children and Families reviews all child abuse and neglect cases. Standardization of this review process is expected by the end of the year, but no plans or legislative agenda is currently underway to establish a mandated, state-wide comprehensive child fatality review system.²⁴

The state of Tennessee has a comprehensive child fatality review system that involves all 31 judicial districts in the state. Each district has at least one review team and there is a state level team coordinating the activities of the local teams. State law mandates that all areas of the state be represented by a CFRT and the review system itself is standardized across the state. The 1997 annual report indicates that although descriptive statistics are calculated, no effort has yet been made to statistically evaluate the impact of the child fatality review

process on incidence of death. However, the annual report further indicates that 98% of children's deaths were reviewed and that 29% were determined to have been preventable. Lastly, it was determined that the process of review resulted in determining a different manner of death in 3% of the cases. In 15% of the cases, following preliminary review and investigation, the manner of death was deferred for determination by the CFRT.²⁵

SIDS and deaths due to abuse were also examined separately as were deaths involving traffic violations, seat belt and safety seat usage, helmet usage, firearms, water safety, smoke alarms and sexually transmitted diseases (HIV/AIDS). The recommendations pursuant to Tennessee's 1997 annual report advocated for autopsies to be mandated for all sudden, unexplained deaths of children under 17 years of age. The report further advocated for standardization of all investigations into suspected SIDS cases.²⁶

The CFRT in Missouri is mandated by law and meets quarterly each year. Each local team submits findings to the state CFRT to identify systemic problems and submit findings and recommendations on means to prevent further child deaths. All counties are represented but only those cases that meet criteria are reviewed. These criteria include deaths that are due to SIDS or unexplained deaths, Department of Family Safety involvement, possible inadequate supervision, suicide or firearm injury, injury while unsupervised, drowning, poisoning, vehicular injury, substance abuse involvement, suspected sexual or physical assault, and other suspicious contributing elements at the discretion of

the panel. The annual report provided detailed incidence and descriptive statistics, suggested interventions and speculated on the possible effects of current interventions on decreasing childhood fatalities, but no statistical analysis was pursued towards correlating the decline in children's death with intervention of the CFRT. The survey respondent expressed interest in the methods being used in this study in order to explore establishing a more empirical correlation between the CFRT in Missouri and fluctuations in children's death rates.²⁷

The child fatality review system in Minnesota is mandated to review those deaths resulting from abuse or neglect; the teams then have discretion regarding the review of other deaths. Reports are generated at the county level and forwarded to the State Child Mortality Review Panel. All counties have a child protection team that reviews local child abuse and neglect deaths. Larger counties have actual child mortality review teams but smaller counties rely on the service of child protective services teams for review of deaths which meet criteria for review. The review process is standardized, but cases reviewed must meet the following criteria:

- ◆ Death was a result of maltreatment or suspected maltreatment.
- ◆ Death is determined to be due to accident, suicide, SIDS or the manner of death could not be determined and involved a child whose family was involved with a social services agency or the child's family had received social service assistance within the past year.
- ◆ The death occurred in a licensed facility.

The responding Department of Health Services source expressed interest in this study. The respondent stated that the Minnesota statistical analysis is “very primitive” and, as such, uses the child mortality review process to improve the child protection system by recommending modifications of procedures, policies or the law, and identification of any gaps in the provision of services and training.²⁸

Alaska reported having a child fatality review component composed of a multi-disciplinary team. However, as the team and process have only been in operation for two years, the system is still in its formative stage and has not yet developed standardization for reporting nor has coverage of all geographical areas of the state been achieved. Representation has not yet been mandated by law and the current process only calls for review of suspicious or remarkable childhood deaths. A separate review team is in place to review infant deaths and, of course, deaths due to SIDS. An analysis of the first full year of data is currently taking place and will, of course, not seek to establish any statistical correlation between incidence and intervention at this time.²⁹

The CFRT process is not yet fully developed in Alabama. However, repeatedly through their publications, the need for a comprehensive review system and the acknowledgement of the benefits is apparent. In their most recent summary report, it is stated, “The death of a child is a community problem. The circumstances involved in most child deaths are too multidimensional for responsibility to rest in any one place. The goal of the Alabama Child Death

Review System (ACDR) is to decrease the incidence of unexpected/unexplained child injury and death by improving our understanding of how and why children die." ³⁰

According to Alabama guidelines, any unexpected/unexplained death of a child under 18 years old shall be reviewed by a Local Child Death Review Team (LCDRT). Unexplained/unexpected is defined as a child's death which prior to investigation, appears possibly to have been caused by trauma, suspicious or obscure circumstances, child abuse or neglect, or other agents such as Shaken Baby Syndrome. These include children who die from vehicular trauma, fires, drowning, abuse, and the unknown. At this time, deaths of babies that are born in a hospital and die before ever leaving that hospital are not reviewed. Nor are the deaths of children who have had a chronic illness and were expected to die (i.e., leukemia, cystic fibrosis, etc.) reviewed. These death certificates are not subject to distribution to LCDRT coordinators for consideration. Alabama promotes commitment to building a broad review process that addresses all preventable child deaths. By adopting this public health approach, a better understanding and greater awareness of all the causes of child deaths can be realized on the local and state level. From these reviews Alabama hopes to identify what puts children at risk of preventable death and take the steps necessary to avoid needless tragedies in the future.³¹

Alabama did not report having a standardized procedure for the in-depth review of child deaths. As of March 24, 2000, 28 Judicial Circuits have ongoing

active local review teams, 10 circuits have identified team members and have a scheduled first review meeting date, leaving 3 circuits with no plan for team development. Without exception, local teams have applauded the review process and commented on how ACDR efforts have helped change agency policy and procedures, distinguish intentional deaths from accidental, and develop new programs that might prevent child deaths. On behalf of the ACDR, the survey respondent stated that due to funding problems, the program is “too new” for a statistical review directed at evaluating the effects of the ACDR on incidence of death at this time. The respondent added, however, “we expect statistical validation possible within the next couple of years.”³⁰

Georgia was found to be extensively represented in the academic literature as well as through internal research and documentation.^{13,14} The respondent to the survey indicated that each Georgia county is required to establish a CFRT to review “sudden or unexpected” child deaths and to report the results of each review to a statewide Child Abuse Prevention Panel. The reporting format to the statewide panel is standardized but the individual counties develop their own protocols. Although the respondent stated that the Georgia CFRT did indeed have a statistical protocol to establish the effect of the CFRTs on the incidence of child fatality,³² review of the Georgia CFRT evaluation³³ and the most recent annual report (1998) indicated that only descriptive statistics were conducted.¹³ However, the Georgia CFRT system was found to be

prioritized on the state and local level and specifically isolated SIDS and abuse deaths as integral to the overall program of preventing children's deaths.¹⁴

Representatives from the Kansas Child Death Review Board acknowledged that their system mandates standardized representation of all counties for all deaths less than 18 years of age. As is the case with the local Child Fatality Review Team, this includes all deaths, regardless of whether due to natural or accidental causes, homicide or suicide, or of undetermined origin. The process includes a standardized report from the medical examiner used to document compliance with procedures. Although no statistical analysis has been pursued to correlate the effects of the Child Death Review Board and a decline in child mortality, the respondent stated that the survey "...asked the question that everyone asked: how do you prove prevention?" The respondent continued by stating,

"We believe we have increased awareness of specific problem areas such as poor sleeping position and appropriate conditions, lack of child restraints, necessity of having operational smoke detectors, importance of proper supervision of young children at all times, the inherent danger of guns in the home, both related to suicide and accidents, and the fact that child abuse resulting in deaths is a real issue."³⁴

This further underscores the objective of this study. The compelling belief is that the peripheral effects of a child fatality review team combine to cause a protective effect. Although this is likely the case, identification of pertinent

information about children's deaths, proper dissemination of this information and the generation of relevant interventions is impossible without the vehicle afforded by the CFRT. Lastly, as with any worthwhile intervention, the association between intervention and effect must be quantifiable.

Despite being one of the forerunners of the CFRT movement, California has a relatively informal system set up to review children's deaths. Representation takes place in 56 of the state's 58 counties, although the manner in which the teams meet is not standardized nor mandated by law. Much like Texas, which will be reviewed in the ensuing section, a law passed in 1988 established a state council and authorized formulation of review teams but did not require for all counties to establish a team. The state council did not subsequently review all deaths, but provided technical assistance and training to local teams. Criteria for review was generally characterized as a review of unexpected or trauma deaths, including SIDS and abuse, although some teams reviewed all deaths occurring to children under 18 years of age at their own discretion.³⁵

In reference to the statistical analysis of the data, the survey respondent stated that:

"There has been no research-based or systematic evaluations of the effectiveness of the local CFRTs in the prevention of child deaths. However, there is documentation that the teams have produced both informal and formal changes to the policies and practices of local

institutions and agencies. However, it is difficult to claim a direct and sufficient causal relationship from the CFRT review and recommendation to action and system change because of the multiple other factors and forces at play in the social and political arenas. Research based or systematic evaluations have not been conducted.”³⁵

Again, the intuitive association is made between intervention and effect.

However, the California survey respondent requested that a copy of this study be forwarded upon its conclusion to consider similar analysis.

Much like Georgia, Oregon has a comprehensive and pervasive child fatality review system. The state team was established by legal statute in 1989 mandating multi-disciplinary team representation in each of its 36 counties. The data is collected according to a standardized process that facilitates analysis by the State Technical Assistance Team (STAT). The criteria for which cases are reviewed is also standardized. This criteria requires the review of unexpected and unexplained deaths, including SIDS and abuse. As a quality control measure, the state team further selects 225-250 previously reviewed cases for revision. Deaths that are physician-attended and do not involve a medical examiner are not usually reviewed, although there are occasional exceptions.³⁶

There has not been a systematic statistical demonstration to determine that the fatality review process has decreased or prevented child deaths in Oregon. However, descriptive statistics have demonstrated that since the inception of the child fatality review teams, a decrease in children's deaths has

been observed. On an individual level, cases reviewed by county teams have identified child abuse and neglect instances that were initially missed, thereby substantiating the element of enhanced accuracy in cause of death determination being afforded through CFRT representation. Further, in the ten-plus years that Oregon has had multi-disciplinary teams, there has been a marked increase in inter-agency cooperation that has enhanced service provision to high-risk children and families, and increased the effectiveness of investigation efforts.³⁷ Again, the associative relationship between the CFRT is assumed and a copy of this study was requested

The state of Maryland has a multi-disciplinary, comprehensive child fatality review team. Of the 24 jurisdictions in Maryland, 14 have local child fatality review teams; the remainder are in the process of setting up their teams in response to Senate Bill 464 which mandated representation as of May 1999. Again, as is the case in Texas, the process for review is standardized across the state but each jurisdiction is autonomous to establish its own multi-disciplinary and multi-agency team. Most teams only review sudden and unexplained deaths, including SIDS and abuse, although some with smaller incidence rates review all cases. Naturally, with the system in its founding stages, there has not been the opportunity to statistically analyze the impact of the intervention, although interest was expressed in regards to the outcome and process of this review.³⁸

The survey respondent from Virginia stated,

“The child death review process is an opportunity to learn about the causes and circumstances of child death in order to prevent deaths in the future. I seriously doubt that any fatality review could ever demonstrate a causal relationship between reviews and decreased mortality.” The annual report further specifies that all data included in the report are “descriptive and should be interpreted cautiously...descriptive data do not provide answers to questions regarding causal factors, but they can point in the direction of more study and they can direct attention to the causes of death that are amendable to prevention efforts.”

The report, however, concludes that:

“Death is also a clearly definable outcome that can be examined in the future to measure the effectiveness of these prevention strategies.”³⁹

Deaths that can be reviewed were divided into three categories: deaths among children less than 18 months old (including SIDS), violent or unnatural deaths (including abuse), and deaths where cause or manner of death are undetermined. The state of Virginia had used the CFRT process to identify suicide among early teens as an escalating problem and was in the process of using information garnered from state child fatality review teams to develop intervention strategies. The response from the Virginia CFRT provided support for two issues. The first is that mortality can be examined as a variable determining the effectiveness of an intervention. The second is that

standardization among teams and between states will facilitate the exchange of effective information and interventions.

The state of Idaho has recently developed a state child fatality review system that represents all counties and reviews all deaths of children under the age of 18. The teams were established by a Governor's decree and as such there is not a legal mandate for representation. The process is standardized since reviews ultimately take place at the state level. This has led to identification of two obstacles in preparing cumulative reports. The first was that initial investigators obviously had varied levels of skill and resources. The second was that the manner of reporting was "inconsistent with information about the events surrounding an incident often being incomplete or not sent at all."⁴⁰ The 1997 annual report was the first comprehensive publication on behalf of the state's CFRT. Children's deaths due to abuse and SIDS deaths were prioritized and the state epidemiologist stated that since this was their first full year of review, it was obviously insufficient to conduct an associative study and expressed interest in the process involved in this research.⁴¹

Delaware has a child death review teams representing all the counties in the state. The CFRT was mandated for select areas by the state as of July, 1995 and is standardized throughout the review process. Most children's deaths are reviewed, specifically including review of SIDS and deaths due to abuse. However, since the criteria is fairly inclusive, it allows for virtually all deaths to be reviewed. Statistical review of impact has been considered, but has not been

pursued due to the relatively small number of deaths throughout the state. The primary purpose of reviewing child deaths, though, is identified as the prevention of future child deaths and is considered as having been met by some of the teams.⁴²

A law creating a Child Fatality Review Process was signed by the state of Massachusetts on August 10, 2000. The law requires that each of the 11 districts headed by a district attorney must set up a local multidisciplinary and multi-agency review team. Since this process has not yet been put into operation, there are no reports or evaluations. It is, therefore, not clear if the process has been standardized or if all deaths will be reviewed. Naturally, there is no report on efficacy or statistical analysis of impact although interest in such an analysis was expressed by the survey respondent.⁴³

Nebraska reports having one state-wide review team established through legislation, but local teams (city, county, etc.) do not have support through state statute. The state CFRT team last issued a report covering 1994-1995 deaths in 1998. All deaths under 18 years of age are reviewed. Current information was not available although the annual report provides a descriptive analysis of the incidence and rates of children's deaths. The report recommends that a more uniform system for the collection of information relevant to children's deaths is warranted. The report further identified that a significant percentage of deaths occurring to children are preventable. Whether these recommendations were

pursued and a process established is not clear. No indication supporting inferential statistical analysis was provided.⁴⁴

Pennsylvania has a child fatality review team with 29 teams covering 33 of the 67 counties. Representation is not mandated by law, but examination of 1998 statistics reveal that 80% of children's deaths were reviewed. Although the process is not mandated or standardized, the teams use a protocol developed by the Pennsylvania Department of Health and Welfare and the American Academy of Pediatrics. For the areas represented by teams, all children's deaths are reviewed and use standardized procedures for the review of SIDS and deaths due to abuse. The survey respondent indicated that the CDRT process has not been statistically demonstrated to prevent children's deaths, but suggested that there's probably some "spill-over" effect since from 1990-1997, the infant death rate has decreased 20 percent and the child death rate has decreased 24%. However, there were no studies to statistically demonstrate whether these decreases are directly related to the review process. Because a significant component of their CDRT process is the investigation of risk factors that lead to the development and implementation of statewide and local prevention strategies (policies and programs) they assume that these efforts in combination with other strategies did have some impact on the decrease in infant and child deaths.⁴⁵ As indicated in the responses from other states, it is not so much the inferred association as it is the need to demonstrate, instead of assume, the association.

This again reinforces the need for a quantitative correlation between the very existence of a CFRT and the impact on children's deaths.

Although South Dakota reported not having a comprehensive, statewide child fatality review team, the survey respondent indicated that three independent teams are providing services to the majority of the state. Since representation is not mandated, not all the areas are represented nor is there a standardized reporting protocol. Some standardization is achieved by having members of the teams overlap with the other teams. There is no indication as to whether SIDS, abuse or any other cause of death is automatically marked for review. No statistical analysis is planned although some cumulative reporting has been generated.⁴⁶

The state of Utah has a state-run child welfare system that divides the state into regions. If a child dies within one of the regions, a central fatality review board evaluates the death to determine if the system's response could be modified to prevent future deaths of a similar nature. If the case is not 'waived' then a multi-disciplinary committee is convened. The committee then determines if changes in the system could be modified. During this past year a pilot program has been tested whereby deaths are reviewed not only by the state fatality review committee, but also by local fatality review committees.⁴⁷ Deaths due to SIDS or abuse are both evaluated for review and usually are examined to some extent. The annual report for 1999 emphasized the evaluation of 88 suspected abuse deaths. The respondent stated that the review process has not been

shown to be statistically significant in reducing children's deaths. However, the annual report stated that in the past year, "the data indicates there was nothing the system did or didn't do that directly contributed to the death of a client." The indication being that there is little systematic change. Curiously, given the religious nature of the population, one of the recommendations in the annual report emphasized a need to change the system for securing parent's authorization to provide necessary medical care to children.⁴⁸

Hawaii's Department of Health, Maternal and Child Health Branch facilitated the creation of a statewide Child Death Review system in 1996. Hawaii's teams are located on all four of the major islands. Additionally, the Department of Defense has a review team that reviews all deaths occurring within the military. All of the state's counties are represented by a CFRT and all deaths are reviewed according to a standardized process mandated by law. The new standardized process has only been operative for the past year and as such has not allowed any comprehensive statistical analysis of the effect on the prevention of childhood death although the survey respondent indicated such a study will be forthcoming.⁴⁹

Colorado reports that a comprehensive child fatality review team does exist and that all 63 Colorado counties are represented in the activities of the review committee. Although representation by a CFRT is not mandated by law, all deaths of children under 18 years of age are reviewed. In response to inquiry about statistical association, the survey respondent stated,

"The effects of the Colorado CFRT process has not been statistically demonstrated to prevent children's deaths. The statistics of child deaths in Colorado over the past 10 years have varied and in some cases deaths have declined. However, the decrease or difference in numbers and rates cannot be purely attributed to our fatality review process, as many factors (such as educational campaigns) also play a role in the prevention efforts."⁵⁰

This is similar commentary to some of the other respondents, although, it must be suggested that the CFRT provides the mechanism that allows for the assimilation of information that fosters the sorts of educational efforts referred to in the preceding response. The research question remains, would the interventions that have caused rates to change occurred without the impetus provided by the process or membership of the CFRT?

In 1989, Montana's legislature authorized the review of fetal and infant deaths as part of a statewide initiative to reduce infant mortality through better services to high-risk pregnant women. Montana then integrated child death reviews to the existing fetal and infant mortality reviews in 1997 and is one of the only, if not the only state with a combined Fetal, Infant and Child Mortality Review (FICMR) team in the country. The FICMR Act, enacted in 1997, encourages local communities to establish voluntary multidisciplinary review teams. Currently, 19 of Montana's 56 counties have established teams, allowing for approximately 70% of the state to be represented. The goal is to expand

coverage to 100% by the end of 2001. Specific deaths, including those suspected as due to SIDS and abuse are nearly always reviewed. The survey respondent stated that, "Establishing a reliable data system has been an ongoing challenge and as such, data analysis has been very problematic and not yet completed."⁵¹ In light of their current analysis, the respondent requested a copy of this study once it is completed.

The Child Death Review Program (CDR) coordinator from Washington indicated that they have had a comprehensive child death review system since 1998. The Department of Health has been funded to develop a statewide network of local review teams, including the maintenance of a data collection system. Every local health jurisdiction (LHJ) has convened a community-based team. There is no statutory mandate for team composition, but there is a standardized process consisting of completion and submission of a state data tool. All unexpected deaths, including SIDS and abuse, are reviewed. However, the review teams of each LHJ have the discretion to review cases according to their own additional criteria. The survey respondent indicated that the CDR is too new to have statistical information on the programs impact, but welcomed a copy of this study.⁵²

The Wyoming Department of Health reported that the state has a Child Major Injury / Fatality Review Team (CMIFRT). However, law does not mandate representation of each county by a CMIFRT and therefore not all the counties are represented. The process is, however, standardized and indicates that only

major injury and unexpected child fatalities are reviewed. These always include deaths due to abuse and usually include deaths due to SIDS. There is no statistical review generated to demonstrate the impact of the teams on children's deaths, but the team publishes a descriptive annual report.⁵³ The annual report indicates that the majority of attention is placed on abuse and maltreatment of children.⁵⁴ The focus of the Wyoming CMIFRT annual report on abuse and maltreatment provides insight into the prioritization of issues within political and geographical regions and further underscores the need for state and national standardization.

The Commissioner of Human Services for the state of New Jersey established the Child Death and Critical Incident Review Board in 1992. Pursuant to the Comprehensive Child Abuse and Treatment Act of 1997, this entity was replaced by the Child Fatality and Near Fatality Review Board. This board oversees the review of all children's deaths throughout the state. The board relies on death records to review cases and therefore is proponent of standardized investigation and reporting procedures.⁵⁹ The annual report indicates that child abuse and maltreatment is prioritized, but SIDS is inferred as a focal point as part of the broader consideration of deaths due to natural causes. Descriptive statistics have been generated in both of the two annual reports, but the survey respondent indicated interest in the process and result of this study in order to consider conducting a similar study in the future.⁵⁶

Child Fatality Review – Texas

There is some variance in the criteria for review of children's deaths within Texas. For example, the local Tarrant County team reviews all deaths of children under the age of eighteen.⁵⁷ In Houston, however, driven by the same Texas state guidelines, due to the large volume of cases and limited resources, the team reviews 20 to 40 cases per month based on priority and circumstance of death.¹⁷ However, Texas reflects those elements of a child death review process which have been demonstrated to be most effective in other states, including centralized oversight and data collection, multidisciplinary representation, comprehensive review and orchestrated dissemination of information. There is, though, one remarkable difference between Texas and many other states: although a state fatality review committee is mandated by law, representation or participation in some sort of child fatality review process is left to the discretion of the counties. This is in light of the fact that the intent and mission of these review teams is driven by the concept that multidisciplinary review and accurately recorded data ultimately result in an environment which serves to prevent the deaths of children.⁵ It is the goal of the researcher to consider evidence supporting a protective effect of the CFRT and thereby contribute towards a body of evidence which would mandate multidisciplinary review representation for all 254 counties in Texas.

The Texas child fatality review protocol reflects those components that are representative of successful child fatality review processes throughout the nation.

Therefore, the Texas child fatality review system is considered by this researcher as a viable vehicle through which to expect a protective effect on the incidence of childhood deaths. However, after an extensive review of the data and literature, further supported by discussions with state child fatality review directors, this researcher has not been able to find a comprehensive analysis of the data that considers the impact on children's deaths by isolating representation by child fatality review teams.^{18,17}

The child death review systems for most other states have been reviewed and evaluated in part to substantiate the effectiveness of the processes and procedures operative in Texas. Missouri, which not unlike Texas, determined that a significant number of child deaths were not being accurately reported,⁷ established a process whereby all 114 counties would be represented by a multidisciplinary child fatality review program.⁵⁸ The Missouri fatality teams differed from Texas in that all the counties were represented but further differed in that only cases which were found to be "reviewable" according to a specified criteria were actually reviewed by a multidisciplinary child fatality review program.⁵⁹ After its fourth year, in a report similar to that released by the Texas Department of Health, the Missouri program reported that its child death review system has:

"...produced a base of reliable data identifying patterns of risk to children.

This places the community in a position to develop prevention strategies to reduce injuries and child fatalities. Through public presentations, newsletters, data reports and responses to academic and media inquiries,

(the team) strives to increase awareness concerning identified patterns and trends as they related to serious children's events." ⁶⁰

Inquiry with the Missouri Department of Health verified, again, as is the case in Texas, that there had not been a comprehensive review that has compared data before and after the inception of the child fatality review process. It appears the report assumes that the child fatality review system is responsible for the increased awareness and prevention programs and that this is not confounded by the suggestion that such awareness and intervention are results of a natural process. However, since not all the counties in Texas are represented by a child fatality review team, this is not an assumption this researcher is prepared to make and thus further justifies investigation and analysis as pursued by this study.

The child fatality review system in Georgia was initiated in 1990. However, the Executive Summary prepared by the Rollins School of Public Health issued in 1996, reported that "Despite six years of effort, the pattern and frequency of child deaths in Georgia is essentially unchanged." ¹³ As a result of implementing the changes that were recommended as part of this review, the Georgia child fatality review system reported in 1998,

"... that refinements in the system can increase the number and accuracy of death investigations and make meaningful contributions towards preventing childhood deaths." ¹⁴

These changes, incidentally, were consistent with the format that guides the Texas teams and included investigation protocols, training and comprehensive multi-disciplinary review.¹³ However, after thorough review and verification through contact with The Rollins School of Public Health, again there is no research which has attempted to isolate the effect of the review process on the incidence of childhood death. The wording of the report itself seems to avoid any direct correlation between the existence of review teams and any sort of protective effect on the incidence of children's deaths. However, the Georgia report strongly infers that accuracy in reporting the cause of death is essential towards preventing childhood death.

Similarly, by improving the accuracy of reporting childhood deaths through review teams, the annual report for child fatality teams in South Dakota states:

"Local, regional, or state infant and child death review teams provide an excellent mechanism for identifying infant and childhood deaths along with establishing a conduit for effecting preventive measures to reduce the number of deaths in these particularly vulnerable age groups." ⁶¹

The effectiveness of the Texas child fatality review process is further corroborated by the similar mechanics of review teams in numerous other states. Consistencies and similarities are reflected in the importance placed on accurate cause of death determination, multidisciplinary representation, comprehensive review, data collection and generation of intervention programs and legislation. However, there is no precedent for pursuing an analysis of incidence rates to

isolate the contribution and effect of the review teams. This includes the absence of any sort of research that attempts to quantify a change in the determination of specific causes of death. The change in the determination of these select causes of death, specifically deaths caused by abuse and Sudden Infant Death Syndrome, are repeatedly cited in the literature as representative of the influence of multi-disciplinary review.^{6,62} As a result of such review, the causes of these deaths are determined with greater accuracy. In turn, these findings and insights have contributed to the efficient allocation of resources and the development of effective intervention strategies.^{14,63}

A common misconception regarding children's deaths is that most are a result of illness and natural causes. This is not the case and as such, underscores the urgency to implement all-inclusive interventions such as statewide child fatality review teams. In Arizona, over 300 children's deaths in one year were found to have been preventable.⁶⁴ Locally, the majority of children's deaths in Fort Worth and Tarrant County in 1996 have been determined to be preventable.¹⁹ The Tarrant County Medical Examiner's Annual reports for 1997 and 1998 further substantiate that the majority of children's deaths were directly preventable. The cornerstone of the child fatality review concept, then, is prevention of these deaths.

The review of the research in other states has served to repeatedly identify that preventive programs have been driven by the data uncovered by review teams. The data generated by a review team is considered substantially

more accurate than reliance on traditionally documented vital records. Research indicates that the mechanics of the review team, which include autopsies and multidisciplinary determination of death, are far more accurate than simply relying on death certificates.^{8,9,65,66}

Furthermore, the mechanics of the child fatality review have been demonstrated to provide increased level of discovery and accuracy in determination of deaths resulting from child abuse^{9,63} and Sudden Infant Death Syndrome (SIDS).^{62,67} Under-ascertainment of children's deaths from these two causes may have significant impact on the course of intervention and ultimately on the incidence of preventable death.¹⁰ It is, therefore, important for this study to investigate change in the determination of death due to abuse and SIDS as it relates to the Texas child fatality review teams so as to further account for the effect of such teams on the prevention of children's deaths.

Indicators by Select Cause of Death

The categorization and consideration of causes of children's death by the Texas CFRT is representative of the manner this information is collected and reported throughout the country. Reports generally categorize causes of death in children as natural and unnatural. Natural causes of a child's death include deaths due to Sudden Infant Death Syndrome (SIDS), cancer, heart disease, congenital anomalies, perinatal conditions, and deaths due to other reasons. Unnatural causes of death include injury mortality, motor vehicle fatalities,

homicides, suicides, drowning, mortality due to fires/burns, poisoning, suffocation/strangulation, and deaths due to abuse and neglect.¹⁸ Often, reports will further consider homicide, and suicide deaths in terms of the mechanism of injury; specifically, whether a firearm was used.

The review of information on the CFRT process throughout the country consistently indicates that SIDS and deaths due to abuse are further explored in the analysis of the performance of the programs. Public and professional awareness of SIDS has increased in the 28 years since the establishment of the National Sudden Infant Death Foundation, now called the National SIDS Alliance. Similarly, awareness of child abuse has increased in the 30 years since the publication of the first article on the battered child.¹⁶ Often there is significant overlap between these two causes of death, an overlap that requires multidisciplinary review to distinguish between the cause of death as natural or unnatural.⁶⁸

Historically, the multidisciplinary review process has been extensively implemented in the review and redefinition of deaths due to abuse and SIDS. The research indicates that the multi-agency, multidisciplinary review process has served to identify these causes of death with more accuracy.^{10,62} The heightened awareness brought to these causes of death over the past generation may also have had a significant impact on incidence. The researcher considered inclusion of these two causes of death as important sentinel markers towards evaluation of the impact of the CFRT process. This is due both to the fact that

awareness of these two issues was widespread and that the CFRT process itself was the ideal catalyst for accurate determination of these causes of death. Therefore, frequency matching of treatment and control groups that did not demonstrate a significant difference prior to the introduction of the CFRT will provide a viable format for testing the impact of the teams on cause of death determination.

This is especially operative when considering SIDS and deaths due to abuse since these two causes of death have been shown to be mis-classified most often.^{10,62,63} The accuracy with which determination of cause of death takes place is an integral component of this study since the accuracy of data used to determine interventions has a significant influence on the effectiveness of those interventions.

Sudden Infant Death Syndrome (SIDS)

Sudden infant death syndrome is defined as “the sudden death of an infant under 1 year of age which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history.”⁶⁹ A comprehensive report on SIDS by the CDC⁷⁰ indicates that although SIDS is a diagnosis of exclusion and of unknown etiology, it is the leading cause of postneonatal mortality in the United States, accounting for approximately one-third of such deaths.^{71,72} The CDC report sought to identify trends in SIDS for the United States for the period

1983 through 1994. Similar to the format conducted by this study, the CDC study compared rates for SIDS between the years of 1983-1989 and 1990-1994. The analysis indicated that annual rates for SIDS declined three times faster during 1990-1994 than during 1983-1989.⁷⁰

To characterize SIDS trends in the CDC study, annual data were combined so that the rate of SIDS for 1983-1989 could be compared with the rate for 1990-1994. These periods were selected for comparison because 1994 was the last full year for which data was available and the implementation during the 1990s of efforts that potentially influenced diagnosis and reporting of SIDS. This included heightened awareness among health care providers about risk factors for SIDS, revision of the definition of SIDS, and initiation of national SIDS prevention efforts, including multidisciplinary review teams. This representation is reflected in the percentage of deaths attributable to SIDS that were followed by an autopsy. These increased from 85.8% in 1983, to 93.4% in 1990 and to 95.7% in 1994.⁶⁹ It is noted, however, in the CDC report that the steady decline in rates for SIDS "may reflect changes in the prevalence of known risk factors of changes in the diagnosis of SIDS."⁷⁰ In the course of analysis of the impact of CFRTs on the incidence of SIDS, it will be virtually impossible to extract the influence of these changes other than by comparing incidence between control and treatment groups based on CFRT representation.

The CDC reported that many of the risk factors for SIDS identified in the 1980s, such as low birth-weight, young maternal age, and poor socioeconomic

status, were not readily amenable to intervention.⁷¹ However, a strong association between infant prone sleeping position and SIDS had been established by 1990.⁷³ During 1992, the American Academy of Pediatrics began recommending that parents place their infants on their back or sides to sleep and during 1994, the national "Back to Sleep" campaign began promoting the non-prone sleeping position as well as other modifiable behaviors (e.g., breastfeeding was encouraged and exposure to tobacco smoke and overheating was discouraged).^{22,72} In the United States during 1992-1995, the SIDS rate declined 30% concurrent with a decrease in the prevalence of prone sleeping from 78% in 1992 to 43% in 1994.^{73,74} Although the prevalence of breastfeeding did not change substantially during the CDC study⁷⁵ the prevalence of smoking during pregnancy declined approximately 25%.⁷⁶ The CDC study, however, concludes by stating that "because the non-SIDS postneonatal mortality rate did not change substantially during 1983-1989 and 1990-1994, a shift in diagnosis probably did not account for the larger declines in SIDS during 1990-1994."⁷⁰ This is not a conclusion the researcher is prepared to accept. Non-SIDS postneonatal mortality is expected to decline.^{3,4,20} The point of this study is to examine if this decline was different in areas as differentiated by CFRT representation.

Infants that died suddenly and unexpectedly were studied as part of the 1998 European Concerted Action on SIDS. Three pediatric pathologists, first independently of each other and later in a consensus meeting, classified 63 cases into 3 groups: SIDS (19 cases), borderline SIDS (30 cases) and non-SIDS

(14 cases).⁷⁷ The distribution of epidemiologically determined risk factors were studied over these three groups. Maternal smoking after birth, low socioeconomic status and thumb sucking were found more often in SIDS than in the other cases. Inexperienced prone sleeping was a determinant for SIDS, but not for non-SIDS. Previous hospital admission, low birth-weight and/or short gestation were associated with borderline SIDS. Non-SIDS cases received more breastfeeding, the parents hardly smoked during pregnancy and after birth, a firm mattress had been used, and more often signs of illness had been reported by the parents, compared with the SIDS and borderline SIDS cases. Bedding factors and both primary and secondary prone sleeping were equally distributed over the three groups which supports the theory that, in SIDS and borderline SIDS, as well as in non-SIDS cases, some similar external and preventable factors might influence the events leading to death. L'Hoir et al. determined that review should focus on all sudden unexpected deaths, after which subgroups such as SIDS cases can be separately analyzed. The postmortem was found to be an essential part of the whole work-up of each case. The researchers indicated that multidisciplinary review of all available data is required to arrive at a sound evaluation of cases and thus "form the basis for the prevention of sudden unexpected infant death."⁷⁷

In March 1997 an international multidisciplinary forum was convened by the National SIDS Council of Australia to review evidence concerning risk factors related to SIDS and to revise and refine guidelines for reducing the risk of SIDS.⁷⁸ The forum provided an assessment of the evidence for

recommendations to reduce the risk of SIDS using an evidence-based process. Strong evidence had been accumulated that indicated the intervention campaigns to reduce prone sleeping during infancy have been followed by SIDS rate declines. Data also indicated that the supine position was not associated with an increase in significant morbidity outcomes and provided greater protection for SIDS than the side position.⁷⁹ Covering of the baby's head by bedding was found to be strongly related to SIDS. Parental smoking was also found to be strongly associated with SIDS. Bed-sharing increased the risk of SIDS amongst smokers but the data were not sufficient to provide complete reassurance to nonsmoking parents that bed-sharing is safe. However, a study by Mosko et al. indicated there may be a correlation between maternal proximity and lethal saturation of infant CO₂ when co-sleeping.⁸⁰ The evidence for a protective effect of breast-feeding was conflicting, so breast-feeding could not be promoted strongly as reducing the risk of SIDS. Immunization was not associated with SIDS. Henderson-Smart et al. concluded that multidisciplinary health professionals help develop and disseminate educational programs based on the evidence garnered by this process. They further anticipated that such education programs lead to a decline in SIDS mortality.⁷⁸

Since the 1992 American Academy of Pediatrics (AAP) recommendation to put babies to sleep in the non-prone position and the subsequent 1994 "Back to Sleep" campaign, the U.S. rate of sudden infant death syndrome (SIDS) has decreased more than 40%. Most parents who place infants on their back report

that a medical professional (56%) recommended this. The majority of those placing infants prone do so because their infant is more comfortable or sleeps better (65%), although 73% said their physician/nurse discussed sleep position with them.²² Non-prone sleeping continues to increase since the initiation of the "Back to Sleep" campaign. Disparity between some demographic groups persists. An excessive number of African-American families and Hispanic families still choose a prone sleep position. Many who do so cite increased infant comfort, despite knowledge of the AAP recommendation.²² Unfortunately, based on the limitations of the data, variables necessary to address sources of education were not available to this study. However, the analysis pursued in the course of this study will examine racial difference in the incidence of SIDS overall and between groups identified by CFRT representation.

"The investigation of sudden infant death involves a careful examination of the infant's medical and social history, an investigation into the circumstances of the infant's death and an autopsy."⁸¹

Byard et al. reviewed 24 consecutive sudden infant deaths. Three (14%) of 21 deaths thought to be SIDS after postmortem examination were attributed to asphyxia following formal case review.

"The multidisciplinary review, including the medical examiner's and autopsy result is essential to the accurate determination of SIDS."⁸¹

It is the intention of this researcher to explore a similar impact by the CFRT on the incidence of SIDS in Texas based on CFRT representation since

the multidisciplinary review process has repeatedly been demonstrated to be much more accurate than simple case or record review.⁸

Although the etiology of SIDS continues to elude definition, increasingly more diagnoses are being made based on autopsy reports and death scene investigations. As these diagnostic practices, characteristic of the representation by a CFRT, become more standardized, SIDS prevalence is expected to change.⁸² Of the numerous possible contributing variables to the incidence of SIDS under investigation, the recurring elemental component is the multidisciplinary review and research process. The CFRT team embodies all the necessary elements of effective intervention. These include convening a multidisciplinary team to include medical, investigative, social and academic personnel, assimilation of information and collection of data, resources for analysis, representation for interpretation and linkages to disseminate appropriate educational and intervention programs.

The literature, much of which was represented by the CDC report, justifiably associated decreases in SIDS with the intervention and educational programs of the past decade. However, L'Hoir et al., Henderson-Smart et al. and Willinger relate this process of intervention with the multidisciplinary process characterized by the CFRT. To adequately examine the impact of the CFRTs in Texas, it is essential to explore whether the CFRT plays a role in enhancing whether deaths due to SIDS are identified with increased accuracy. It is suspected that unexplained and sudden deaths have been determined as SIDS

almost by default in the past. With heightened awareness and increased scrutiny, however, it is the researcher's expectation that rates of SIDS will demonstrate a decrease among those counties with multidisciplinary review.

Deaths Due to Abuse

In contrast to the changes expected in rates of SIDS deaths, it is hypothesized that the rate of abuse as cause of death determination will have increased when marked by CFRT representation. Recent surveys throughout the United States have suggested escalation in fatalities due to child abuse. A study by McClain et al. sought to explore verification of these indicators by reviewing death certificates. Their finding indicated that "about 85% of child abuse and neglect deaths are recorded as due to other causes."⁸³

Ewigman et al. argue that estimates of the incidence of child maltreatment fatalities vary widely; most experts believe they are underreported. To investigate the suspicion that fatal maltreatment was underreported in Missouri preschool children, the researchers conducted a statewide, population-based study using nine data sources. The study cases included the 384 children younger than age 5 who died from 1983 through 1986 and whose death certificates were coded with an external cause (injury) or whose deaths were substantiated as abuse or neglect fatalities by the Missouri Division of Family Services. Each fatality was categorized as one of the following: definite maltreatment, probable maltreatment, possible maltreatment, non-maltreatment, or inadequate

information. Of the 121 cases classified as definite maltreatment, only 47.9% had codes consistent with maltreatment on their death certificates. The Division of Family Services had substantiated 79.3% of definite maltreatment cases as abuse or neglect fatalities. The Federal Bureau of Investigation Uniform Crime Reports database reported only 38.8% of these cases as homicides. Child maltreatment fatalities are drastically underreported as such in Missouri, and likely many if not all other states, because of inadequate investigations, lack of information-sharing between investigators and agencies, and reporting systems that fail to capture the contribution of maltreatment as a cause of death. In response, however, Missouri has since created a statewide system of child fatality review panels and a child fatality surveillance system to address the problems documented in this study.⁶⁵

The Ewigman study exemplified the need for multidisciplinary review panels and coordinated statewide systems. A complementary objective of such review is to establish an at-risk profile in order to prevent future incidents. DeSilva and Oates employed the review process in establishing a profile of children killed due to abuse.⁸⁴ Their findings indicated that the most common age for fatal child abuse is the first year of life. Therefore, when physical abuse occurs in children under three years, and particularly under one year, a thorough assessment, follow-up and institution of appropriate supportive services are essential, as the abuse may be an early warning of a subsequent fatal episode of abuse. Curiously, O'Halloran et al. report a correlation between SIDS and child

abuse, raising suspicion in these cases as well.⁸⁵ The authors conclude by supporting the introduction of a process of review of child deaths to include child protective officials to increase awareness of and help prevent fatal child abuse.⁸⁴

Injury is the leading cause of death in children 1 year of age and older in the United States. Yet, there has been little published on causes of injury deaths in Texas children until the advent of the CFRT. This prompted Cooper to state:

“We must continue to support research and intervention strategies to combat this alarming public health problem.”⁸⁶

The leading causes of injury death varied by age group, but motor-vehicle injuries were the leading cause of injury deaths in all age groups 1 year of age and older. In addition, these data demonstrated the need for intervention in drowning deaths in every age group, choking deaths in infants, suicides in Anglos (especially teenagers), and homicides in infants, teenagers, and blacks. These data underpinned the interventions that have resulted in an overall decrease in death rates for children in Texas. It is essential to establish what, if any, effect the assimilation and dissemination of information afforded by the CFRT has had on children’s death rates.⁸⁷

Armstrong et al. examined the effectiveness of a child abuse surveillance and intervention program in protecting infants at risk by conducting a retrospective review of all children discussed by the Suspected Child Abuse and Neglect Team. The review resulted in a total of 2126 children deaths being discussed by the team; 375 were infants (less than 12 months of age) at the time

of the initial discussion. Nine infants died suddenly and these nine deaths were examined in detail. All of these deaths were initially considered to be due to sudden infant death syndrome (SIDS), but autopsy findings in six suggested death was not accidental and in the other three significant doubt was raised by the history. Identifying risk factors for non-accidental injury were clearly present in all cases. However, there were major problems with notification to the appropriate authorities. Even in cases where appropriate identification and notification occurred planned interventions by multiple agencies failed to prevent death of these infants.⁶⁷ This may indicate another element of the CFRT that warrants scrutiny and cultivation.

The researchers, Armstrong and Wood, concluded that there is a growing awareness of child abuse as a significant cause of morbidity and mortality in developed countries, but intervention and prevention programs are still in need of development. The recommendations, albeit in another country, include the generation of multidisciplinary and inter-agency teams. Additionally, the authors stated that "inappropriate death recording procedures may result in some sudden deaths being recorded as SIDS when in fact they are caused by child abuse."⁶⁷

An integral component of the child fatality review process often begins at a clinic or hospital. Physicians must be aware of the possibility of undetected child abuse as the underlying cause in unexplained and unexpected deaths. A study by Christoffel et al. sought to develop guidelines for clinicians that must decide when to explore the possibility of child abuse or neglect when a child dies

unexpectedly. In the course of the study, there were 43 such deaths during two years. The majority, 27, were due to natural causes. However, nine deaths were related to suspected child abuse or neglect and in three of those cases evidence of injury was found only at autopsy. The abuse cases were more often mistaken for medical illness than for inflicted injury, indicating that autopsy and postmortem skeletal survey are warranted whenever a child dies unexpectedly.⁸⁸ Medical representatives of the review process must investigate the possibility of abuse whenever unsuspected trauma is found post mortem, there is direct physical or social evidence of child abuse or neglect, or the child is in the high-risk group and hospital-based investigation fails to eliminate the possibility that maltreatment contributed to the child's death...all issues raised and investigated by the CFRT process. Prior to CFRT review, though, all cases of children who die unexpectedly or from inadequately explained conditions, will have been referred to the coroner, and autopsies performed.²¹

The data accessible in this study was not capable of isolating the clinical or medical contribution. However, the representation and subsequent impact of the medical component will be indirectly represented as an integral part of the CFRT membership. The issue of awareness and sensitivity to possible deaths due to abuse on the part of the clinical component is important to this study since this is likely where the reporting process will begin. Unfortunately, studies have indicated that documentation of pediatric trauma often remains inadequate to differentiate accidental trauma from abuse.⁸⁹ This documentation is often the

primary point of reference in the CFRT review process and may insinuate an artificially low incidence rate.

More than 3 million children are abused and/or neglected each year in the United States. Between 6,000 and 7,000 children die each year as a result of some sort of abuse. Research is conducted on pediatric homicides to increase awareness of the common scenarios and case histories, demographics of the victims, causes of death, and perpetrators of pediatric homicide in order to develop effective intervention strategies.⁹⁰ A review of the literature on the prevention of deaths due to child abuse indicates that review and representation by a multidisciplinary, multi-agency team is an effective mechanism towards the development of interventions which ultimately reduce childhood deaths.⁹¹

Recommendation for Further Research

Overall, children's death rates have been declining in Texas since 1980, except for deaths caused by homicide, suicide and firearms.¹⁸ Dr. John Hellsten, Epidemiologist with the Texas Department of Health and proponent of the Texas review system stated,

"Direct comparison of mortality rates between counties with and without Child Fatality Review Teams (CFRTs) may prove elusive due to a decline in rates being attributable to multiple factors. On the other hand, this association is exactly what the Texas CFRTs hope to achieve and perhaps can already be statistically identified."

Two separate analytical perspectives are necessary to adequately examine this association. Direct comparison of death rates may prove compelling. However, numerous other variables may be considered as contributing to the effect. Examination of a specific component of the CFRTs mission, accurate determination of cause of death, may unequivocally support results indicated by a broader review achieved by comparing incidence rates. It has been demonstrated that accurate determination of the circumstances surrounding children's deaths result in interventions that successfully impact the occurrence of such deaths. It is therefore proposed that a "two-pronged" approach be pursued to effectively isolate the impact of the CFRT. One perspective considers a broad review by comparing incidence rates and the other analyzes a specific, although essential component, of the effect of a CFRT by examining the accuracy with which data is collected. As with all studies, the strengths and weaknesses of previous research efforts have determined the path of this study.

Performance evaluations specifically correlating a public health intervention with the behavioral outcome is currently being extorted by the Centers for Disease Control and Prevention (CDC) as the only acceptable manner of evaluation. Traditionally, establishing a level of satisfaction on the part of the participant involved with an intervention or simply demonstrating the retention of new knowledge were considered acceptable outcome measures for an intervention. Intuitively, the presenters concluded that the intervention

therefore was achieving its desired impact. However, the new paradigm for establishing the effectiveness of an intervention is to demonstrate the program's impact in behavioral and quantifiable terms.⁹²

CHAPTER III

METHODOLOGY AND RESEARCH DESIGN

Data Source and Collection

The researcher secured non-identifying birth and death records from the Texas Department of Health and the Bureau of Vital Statistics through the Epigram Database and other vital statistics information through direct contact with support personnel from the Texas Bureau of Vital Statistics. The Epigram database provided descriptive information on births and deaths in Texas as well as underlying cause of mortality data. The database was developed by Dr. Daniel Goldman of the Bureau of Chronic Disease Prevention and Control at the Texas Department of Health. The Epigram program provided statistics regarding population, number of deaths, death rates, years of potential life lost (YPLL), YPLL rates, and confidence intervals, although only a few of these were used for the purposes of this study. Access to the Epigram database was secured through registration with the Texas Department of Health and the issuance of an approved access code for electronic access to the data via the Internet.

The Epigram database provided data for all deaths between the ages of birth and seventeen for the years 1985 to 1998 along with the gender, race, cause of death, and county of residence of each child. ICD-9 coding identified the cause of death. The Epigram database provided age-adjusted death rates

for each age, age group, select cause of death and county of residence. These analyses were performed on the entire data set for each age group and year by county. Missing data and verification of data was accomplished by using death and population data from the Texas Department of Health (TDH) and calculating death rates by using the 1997 Microsoft Excel program. All rates are calculated to represent age-adjusted death rates per 100,000 population. These rates were calculated to reflect rates specific to the age, age group, gender or racial/ethnic group under consideration. This allowed for comparability between and within groups regardless of demographic composition.

The desired data was transferred manually from the epigram database to SPSS and Excel; as it was not possible to transfer the data directly. This necessitated that the data requested and generated from the Epigram database be printed onto hardcopy and then entered into an SPSS or Excel database. To minimize research error and ensure accuracy of the data transfer, the data was entered into the database twice and thereby verified for consistency.

Research Design and Methods

The Statistical Packages for Social Sciences (SPSS), both 9.0 and 10.0 versions, for Windows statistics program were used to perform statistical analysis and a 0.05 level of significance was used in testing the hypotheses. The study utilized a retrospective, population-based study design. The analysis complied with the following format.

Univariate analyses were conducted to generate descriptive statistics that characterized the data. This was accomplished by conducting analysis of the demographic variables to yield information including frequencies, means, medians, modes, distributions and other overall description of the data. This general description further provided measures of dispersion and variation including range, percentiles, variances and standard deviations, as appropriate. These analyses are presented to reflect age, gender, race/ethnicity, year and select cause of death by age and age groups by county and between counties marked by review team status. Identified demographic differences were tested for significance as appropriate. For example, analysis of variance (ANOVA) tests were conducted to establish differences between racial groups.

In order to ensure an adequate sample size while including those counties that would be most representative of the CFRT process, the researcher included only those counties that have been represented by an operative CFRT for the longest period of time. This resulted in three treatment groups defined by those counties whose teams were initiated in 1992, 1993 and 1994. The treatment groups, as defined by teams initiated in these three years, reflected consideration of 63 of the 138 counties that are currently represented by a CFRT. The 1992 treatment group contained five counties; the 1993 treatment group contained two counties; and the 1994 treatment group contained fifty-six counties. The overall treatment group contained 43% rural counties as defined by the Texas Border Health Program indicating a county population of less than

50,000 people. Lastly, although the 1993 treatment group only contained two counties, rates were calculated for each age group by gender and race/ethnicity for the years before and after initiation of the CFRT thereby resulting in 240 separate data points. This represented more than an adequate sample size.

The control group was selected based on basic frequency matching techniques. Since the largest of the treatment groups contained fifty-six counties, the fifty-six counties with the largest population, but without ever having been represented by a CFRT, were selected as the control group. This resulted in an overall population of 5,979,801 people in the treatment group counties and 3,116,417 in the control group counties. However, since all statistical analyses were conducted by using rates, these population differences were insignificant. Further, the overall control group reflected representation by 35% rural counties. Differences between rural and urban representation in the two analytical groups were not significant. Rates for the control groups were re-calculated to reflect those years represented by the treatment groups (1992, 1993 and 1994). The counties included in the control group and each of the treatment groups are presented in Appendix A.

Inferential statistics were conducted to test the hypotheses. In reference to the first hypothesis, (H_1) counties represented by a Child Fatality Review Team (CFRT) demonstrate a decrease in the incidence of childhood mortality when compared to counties that have not been represented by a CFRT, the researcher

used several statistical tests to explore the effect of representation by a CFRT on the death rates of children.

The first of these tests was to examine whether the mean or, average, child death rate for children is different between counties with and without a CFRT. Towards this end, the researcher conducted a series of three separate, but related and dependent, Student's t-tests. This first t-test determined whether counties with a CFRT, the treatment groups, reflected different mean child fatality rates when comparing those years prior to the initiation of the CFRT with those counties without a CFRT (control groups). This established whether there was a statistically significant difference between treatment and control counties before the introduction of the intervention (representation by a CFRT). This was necessary to establish those counties without ever having had a CFRT as a viable control group for comparing rates. Absence of a significant difference effectively established the viability of these groups as comparison groups. A second t-test was conducted to determine whether there was a statistically significant difference between the mean death within the treatment group for the period before and after introduction of the CFRT. Since this may simply indicate a naturally occurring effect, a third test was necessary. T-tests were then conducted between those counties with a CFRT (treatment groups) and those counties without a team (control groups), when considered over the same time period, to indicate the effect of CFRT representation. Lastly, conducting several t-tests lost no power, since each test was independent of the other.

The three comparison groups, reflecting the time periods segmented equally between initiation of the CFRT and the period of time before and after inception through 1998 (the last full year for which data was available), were divided as follows:

- 1985-1991 vs. 1992-1998
- 1987-1992 vs. 1993-1998
- 1989-1993 vs. 1994-1998

Data was collected by age group (Birth-11 months, 1-5 years, 6-10 years, 11-15 years and 16-17 years), by race/ethnicity (White, Black, Hispanic, Other), and by gender (male and female) thereby resulting in 20 separate data sample points for each year. As mentioned, this ensured adequate sample size for analysis despite the limited number of counties in certain groups. Further, adequacy of sample size for the control group is not a concern since this group will be made up of 56 counties matched to the corresponding treatment group by years under consideration and matched specifically to the 1989 - 1998 treatment group, which also represents 56 counties.

Quantitative analysis conducted by comparing means was essential to examine the overall effect of the CFRT on death rates. However, since this research was more concerned with the practical issue of preventing death, the object of measurement was to determine the absence or presence of risk or preventive factors. These, then, are essentially nominal categories, since the numbers under consideration represented a proportion of individuals (rates) and

not actual numerical measurements. As such, a non-parametric test was also considered necessary to provide a complete and comprehensive analysis. Towards this end, chi-square analyses were conducted to examine the differences in proportions of children who died in counties with and without the CFRT intervention.

Drawing on the results of the t-test conducted previously, the rates for children's deaths for the years preceding intervention will have established those groups without CFRT representation as viable control groups for comparative analysis. The chi-square test was then used to evaluate the statistical significance of the association between the observed rates and the expected rates (as indicated by the control group). The significance of the proportional difference, if any, of the rates between those counties with and without CFRT representation was thus determined by using the chi-square test. Finally, odds ratios were calculated with 95% confidence intervals to describe the protective effect, if any, of the intervention (CFRT representation).

Towards examining the first hypothesis, the first two tests provided some insight into the overall effect of a CFRT but they did not provide any indication regarding the temporal qualities of the intervention. This is an important consideration from two perspectives. First, if an overall effect were detected, how many years would a CFRT have to have been operative prior to significantly impacting death rates? Second, perhaps there is a significant effect which is contingent on the intervention having been operative for several years, but this

effect cannot be identified when considering the overall data. This examination is necessary to examine the temporal requirements of a CFRT. Specifically, if an effect is detected, it is important to establish how many years a CFRT must be operative before this effect succeeds in impacting children's death rates.

The essential question of this study is whether childhood mortality rates change over time due to the intervention represented by the introduction of a CFRT. A linear regression, predicting the effects of an intervention and determining whether the actual events occurred within expected parameters is not appropriate for this test since there is an expected curve to the effect and results would be invalid and possibly misleading.⁹³ This would result in the predictive line reflecting excessive error at the mid-point and at either end. The preferred test, then, is an interrupted time series analysis since the researcher is seeking to examine the effects of an intervention that may interrupt the ongoing pattern of events...the expected curve, or trend. Therefore, the researcher used an interrupted time series analysis to examine the effects of child fatality review teams on the ongoing incidence of childhood mortality. Specifically, in this case, use of an Autoregression Integrated Moving Averages (ARIMA) technique was indicated.^{94,95,96}

"The autocorrelation function provides a method for the investigator to test hypotheses about the nature and pattern of relationships between measured and latent variables. Patterns of phenomena can be analyzed statistically using objectively provided criteria. The autocorrelation function can also be

used to understand the change in response or behavioral patterns following an experimental intervention. Traditional group comparison designs, using cross-sectional data collection strategies cannot identify differences within the individual nor can they identify patterns of behavior or structural patterns within the data. Autocorrelation and cross-correlation become threats to statistical validity when conventional methods are used; however, in time-series analysis, autocorrelation allows close scrutiny of the pattern of response within an individual across a time-dimension.”⁹⁷

The most recent Statistical Packages for Social Sciences (SPSS) 10.0 program was utilized for the ARIMA analysis since it is not available on the SPSS 9.0 program used for the preceding analyses. The ARIMA considered an equal number of years preceding and following the advent of a CFRT in each of the 68 represented counties, thereby assuring an adequate sample. The analytical ARIMA process conducted by the SPSS 10.0 program consists of first establishing whether the data is stationary or non-stationary. If it is found to be non-stationary, or “scattered” the computer uses a method of “differencing” the data until it becomes consistent for analytical purposes. This identifies the data as moving consistently in one direction, referred to as a trend, or depicts a gradual change one way and then a gradual change in another, which is called a drift. The primary cause of drift or trend is the dependency of values at one point upon previous values, known as a serial dependency. The computer calculated an autocorrelation coefficient that describes this serial dependency between data

points. Fluctuations in serial dependency reflect the effect of other variables that contributed towards the trend or drift in childhood mortality. The result of the computer's "differencing" of the data in order to achieve stationary data effectively accounted for the contribution of variables other than the introduction of a child fatality review team. The auto-correlational coefficient allows the researcher to determine the reliability of a predictive trend or drift and allow for the establishment of a predictive autoregression model. The computer employed this process to generate models describing the data for the years prior to and following the introduction of the CFRT. The final step involved analysis of pre-intervention and post-intervention data, comparison of the two ARIMA models, and determination whether the computed difference, if any, was significant. In other words, the ARIMA analysis examined whether the three treatment groups exhibited a significant difference in the incidence of children's deaths from what otherwise would have been expected for the same time periods. Analysis, of course, was conducted with the null hypothesis perspective that there would be no difference occurring.

In regard to the second hypothesis, (H_2), when comparing the determination of select causes of death, specifically Sudden Infant Death Syndrome and deaths due to abuse, counties represented by a Child Fatality Review Team reflect changes in the determination of these deaths when compared to the incidence of these deaths prior to or without representation by a CFRT, the researcher again considered analysis from several perspectives. The

Student's t-test was used to test for significant change between cause of death due to abuse or SIDS for those years and counties prior to and following fatality review representation. Again, since any detected effect may have been the result of a natural process, the period prior to the introduction of a CFRT (for both counties with and without a CFRT) was tested to determine the viability of those counties without CFRT representation as a reliable control group. The rates for determination of death as due to either SIDS or abuse were then directly compared and tested. This was again complemented by conducting a Chi-square analysis to determine if incidence and death rates, categorized by cause of death, deviated significantly from expected parameters when considering representation by a fatality review team.

The Autoregression Integrated Moving Average (ARIMA) analysis was used to determine if there was a difference between the rates predicted by the years preceding the CFRT and thereafter for both SIDS and deaths due to abuse. The same approach as described for examination of the first hypothesis was used to test the conformity of rates and incidence in these two causes of death to the line predicted by the years preceding fatality review representation.

Lastly, odds ratios and corresponding 95% confidence intervals were computed for all the relationships tested. This provided a measure of the protective or negative effect the intervention may have had on children's death rates. The odds ratio provides a complementary indicator to the ARIMA test in that it estimates the direction and magnitude of a predicted trend or other effect.

The corresponding confidence intervals provide an indication of the reliability of this estimate.

Theoretical Development

This study was driven by retrospective, population-based trend analysis of existing, public access data. There was no use of human subjects in an experimental capacity. No information was used that could specify or infer the identity of any of the subjects included in analysis. The Institutional Review Board of the University of North Texas Health Science Center reviewed the data collection protocol and waived any restrictions on the use of this data. A copy of this waiver is available upon request.

Summary

It is admittedly a limitation of this study that variables that may substantially affect the study question cannot be isolated or controlled. Due to these possible confounds, the hypotheses are being examined from several statistical perspectives. Qualification of the control group by conducting a t-test before testing the effect of CFRT established the two groups as viable and comparable entities and enhances the reliability with which the test results can be considered. Further, examination of the hypotheses by performing a chi-square analysis test examines the proportions of the results instead of simply

comparing means and provides differing, although complementary, statistical inference.

The time series analysis technique (ARIMA) provides the tool for analyzing the unique fluctuations through time of the rates under consideration.⁹⁸ The literature review and the reported trends indicate that there is a naturally expected decline in the death rates of children. The ARIMA test serves to determine whether the predictive curve identifying this trend conforms to expected parameters between groups marked by CFRT representation. Lastly, calculation of odds ratios and corresponding confidence intervals provides a measure of the protective or negative effect of the intervention and degree to which this effect is considered significant. Other pervasive variables, such as enhanced awareness of SIDS and sensitivity to deaths due to abuse, may have an effect on the incidence of death rates in general and those due to specific causes. However, the multiplicity of statistical analysis, including the ARIMA and chi-square tests, should indicate if there is an effect specific to the CFRT since the influence of other interventions will have been distributed throughout the study population.

CHAPTER IV

RESULTS

Hypotheses

The test results described in this chapter provide statistical inference towards the resolution of the following two hypotheses:

- H₁: Counties represented by a Child Fatality Review Team demonstrate a decrease in the incidence rates of childhood mortality when compared to counties without representation by a review team.
- H₂: When comparing the determination of select causes of death, specifically Sudden Infant Death Syndrome and deaths due to abuse, counties represented by a Child Fatality Review Team reflect changes in the determination of these deaths when compared to the incidence of these deaths prior to or without representation by a review team.

The results will be presented by providing descriptive statistics and then providing inferential statistics. The results will be discussed in the summary component of this chapter.

Results (Descriptive)

All calculations were conducted using rates in order to compensate for differences in populations and present the data in comparable units of measure. Death rates were identified as occurring per 100,000 population within specified groups. An analysis of variance (ANOVA) was conducted to test the difference between racial and age groups. All groups were determined to be independent and their differences significant at the $p < .001$ level. A summary of the descriptive analysis of the data used to test the hypotheses is provided as follows:

Overall mean death rates for all causes, genders and races combined is presented in Table 2.

Table 2: Overall means; treatment and control groups (Rates are per 100,000):

Year / Treatment Group	Overall Mean Death Rate	Year / Control Group	Overall Mean Death Rate
1985-1991 Treatment	245.67	1985-1991 Control	215.72
1992-1998 Treatment	170.82	1992-1998 Control	196.69
% Change	31%		9%
1987-1992 Treatment	207.62	1987-1992 Control	225.78
1993-1998 Treatment	139.28	1993-1998 Control	194.21
% Change	33%		14%
1989-1993 Treatment	247.41	1989-1993 Control	196.62
1994-1998 Treatment	170.02	1994-1998 Control	197.56
% Change	30%		-1%

As anticipated, there is a decline between the two sets of years for both the treatment groups (counties marked by CFRT representation) and control groups (counties without CFRT representation), except for a slight increase in the 1994-1998 control group. However, the declines in the treatment group for the

intervals before and after intervention (introduction of the CFRT) are consistently greater than for the control group, as demonstrated by the percentages provided in Table 2. .

Descriptive information for the treatment and control groups spanning the 1985-1991 and 1992-1998 period under consideration is provided in Table 3.

Table 3: 1985-1991 and 1992-1998 treatment and control groups, by gender, race, SIDS and Abuse (Rates per 100,000):

Category	Male Death Rate		Female Death Rate	
	1985-1991	1992-1998	1985-1991	1992-1998
Race / Treatment Group				
White	229.3	245.8	167.4	132.1
Black	461.1	335.8	353.6	251.0
Hispanic	443.4	214.6	229.5	143.4
Other	167.4	118.9	121.7	61.3
Total	325.3	228.8	218.0	146.9
Race / Control Group				
White	228.2	187.6	180.3	148.6
Black	322.4	331.3	261.9	363.6
Hispanic	212.3	207.2	185.2	140.1
Other	73.1	161.2	83.1	93.3
Total	209.0	221.8	177.6	186.4
Age Group / Treatment Group				
Birth – 11 months	1134.8	791.1	906.3	627.7
1-5 Years	55.4	38.3	44.6	31.3
6-10 Years	95.6	23.1	17.8	16.4
11-15 Years	215.3	141.9	73.4	22.2
16-17 Years	125.4	149.5	48.3	37.1
Total	325.3	228.8	218.0	146.9
Age Group / Control Group				
Birth – 11 months	820.9	889.9	757.7	674.0
1-5 Years	48.5	52.8	35.4	35.8
6-10 Years	25.9	26.4	19.0	155.7
11-15 Years	53.9	39.4	29.7	23.8
16-17 Years	95.9	100.7	46.2	42.7
Total	209.01	221.8	177.6	186.4
SIDS / Treatment Group				
White	102.4	89.4	57.9	55.8
Black	179.5	163.1	135.0	99.4
Hispanic	76.8	77.4	49.2	54.9
Other	42.6	17.6	17.3	46.8
Total	100.3	86.9	64.8	64.2

(Table 3, continued)

Category	Male Death Rate		Female Death Rate	
	1985-1991	1992-1998	1985-1991	1992-1998
SIDS / Control Group				
White	132.2	103.0	81.2	87.1
Black	231.6	253.8	185.2	151.8
Hispanic	99.5	81.3	80.6	53.6
Other	42.7	66.3	0.00	17.3
Total	126.5	126.1	86.7	77.4

The descriptive mean death rates provided in Table 3 indicate that the death rate for White males increased in the treatment group (groups with CFRT representation). The death rates for Black males and females both increased in those counties without CFRT representation (control group). The death rates for both males and females also increased in the control group for those individuals listed under 'Others.' This may indicate that minority groups outside those usually categorized (Black and Hispanic) are experiencing higher death rates in counties without CFRT representation. Lastly, the overall total death rates in the control counties increased for both males and females between the two time periods whereas the rates decreased for the treatment group between the same two time periods. All age groups reflected a decrease in death rates in the treatment group except for 16-17 year old White males, perhaps influencing the overall death rate for Whites previously identified. Conversely, in all except one age category (11-15 years) males in the control group experienced increased death rates. Overall, females in the control group experienced an increase in death rates but demonstrated decreases in death rates for the birth through 11 month, 11-15 year, and the 16-17 year categories. Death rates due to SIDS in the treatment group decreased in all except Hispanic and Other females. The

control group for SIDS reflected increases in Black males, White females, Other male, and Other female babies (Birth – 11 months).

Death rates due to abuse could not be presented in terms of age groups due to very low frequencies and are presented for the treatment and control groups 1985-1991 / 1992-1998 by race with both genders combined in Table 4.

Table 4: Mean death rates by gender and race for deaths due to abuse / treatment and control groups 1985-1991 and 1992-1998 (Rates per 100,000).

Race	Male and Female Death Rate (Abuse / Treatment Group)		Male and Female Death Rate (Abuse / Control Group)	
	1985-1991	1992-1998	1985-1991	1992-1998
White	4.03	0.00	0.09	2.05
Black	0.00	9.26	0.50	0.00
Hispanic	2.49	0.00	0.09	0.30
Other	0.00	0.00	0.00	0.00
Total	1.62	2.31	0.17	0.53

Death rates due to abuse increased in both the treatment group and control group. There was a substantial increase among Black males in the treatment group although a decrease in death rate among this same population was identified in the control group. Both White and Hispanic females experienced increased death rates in the control group. However, any interpretation made from these descriptive rates must be tempered by the influence of very low frequency rates. As per speculation by the researcher, the treatment group may demonstrate an increase in cause of death determination as due to abuse as a result of the multidisciplinary review process. The corresponding, although slight, increase in the control group may indicate increased incidence or improved investigative procedures.

Table 5: 1987-1992 and 1993-1998 treatment and control groups, by gender, race, SIDS and Abuse (Rates per 100,000).

Category	Male Death Rate		Female Death Rate	
	1987-1992	1993-1998	1987-1992	1993-1998
Race / Treatment Group				
White	200.1	120.6	113.5	127.4
Black	380.0	292.2	338.6	110.5
Hispanic	214.9	189.9	164.2	141.3
Other	102.4	59.8	58.4	205.9
Total	224.3	166.2	168.7	146.4
Race / Control Group				
White	223.0	186.0	148.0	147.1
Black	368.9	322.5	114.8	379.7
Hispanic	210.0	211.4	146.6	140.6
Other	105.7	162.9	310.3	108.9
Total	226.9	220.7	179.9	194.1
Age Group / Treatment Group				
Birth – 11 months	918.0	625.5	730.8	621.0
1-5 Years	41.0	29.6	28.5	27.9
6-10 Years	20.9	25.7	11.0	21.5
11-15 Years	41.7	26.9	26.7	20.9
16-17 Years	100.0	123.2	46.5	40.7
Total	224.3	166.2	168.7	146.4
Age Group / Control Group				
Birth – 11 months	903.1	892.8	635.4	685.0
1-5 Years	52.3	50.3	30.2	38.3
6-10 Years	29.9	26.2	177.2	179.4
11-15 Years	45.9	37.9	23.1	23.3
16-17 Years	103.3	96.2	33.7	44.4
Total	226.9	220.7	179.2	194.1
SIDS / Treatment Group				
White	175.9	84.2	71.5	29.2
Black	194.6	128.1	279.9	132.0
Hispanic	160.2	92.4	92.4	41.6
Other	181.0	60.0	0.00	0.00
Total	178.5	90.0	115.9	48.4
SIDS / Control Group				
White	131.4	106.4	74.6	86.9
Black	204.5	274.2	170.5	162.8
Hispanic	112.2	81.3	81.7	53.6
Other	49.8	66.3	0.00	17.3
Total	127.8	127.6	84.8	76.7

The descriptive mean death rates for 1987-1992 and 1993-1998 reflected an overall decrease among death rates for males of all races in the treatment group. However, an increase in death rates was observed among White and

Other females in the same group. The control group indicated a slight increase in Hispanic males and Other males and a substantial increase in Black females which accounted for an increase overall among female death rates in the control group. Males in the treatment group had an increase in death rates in both the 6-10 year and 16-17 year groups although, overall, males in the 1987-1992 and 1993-1998 treatment group experienced a decline in death rates. Females in this group also demonstrated an overall decline and a decrease in all age groups except among 6-10 year olds. The control group for 1987-1998 reflected a decrease among males of all age groups and overall. Conversely, control group females for this period experienced slight increases in each age group and overall.

The SIDS treatment group reflected substantial decreases among death rates for males of all races and overall. This was also the case for the female treatment group for 1987-1998, with declines among all races and overall. The 1987-1998 control group for SIDS, reflected a slight overall decline among male death rates and a decline in death rates among females. However, White females and Black males in the 1987-1998 control group demonstrated increases for this time period. These results were very consistent with the 1985-1998 SIDS treatment and control groups, although the decrease in death rates among females in the 1987-1998 treatment group were substantially higher than in the previous group. The death rates among both males and females in the control groups for 1985-1998 and 1987-1998 decreased in similarly slight increments.

Death rates due to abuse could not be presented in terms of age groups due to very low frequencies and are presented for the treatment and control groups 1987-1992 / 1993-1998 by race with both genders combined in Table 6.

Table 6: Mean death rates by gender and race for deaths due to abuse / treatment and control groups 1987-1992 and 1993-1998 (Rates per 100,000).

Race	Male and Female Death Rate (Abuse / Treatment Group)		Male and Female Death Rate (Abuse / Control Group)	
	1987-1992	1993-1998	1987-1992	1993-1998
White	4.03	0.00	0.11	2.37
Black	0.00	10.8	0.50	.000
Hispanic	2.90	0.00	0.10	0.30
Other	0.00	0.00	0.00	0.00
Total	1.75	2.50	0.19	0.63

Although death rates decreased for Whites and Hispanics, death rates due to abuse increased overall in the treatment group owing to a substantial increase in abuse death rates among Blacks. Death rates also increased slightly overall in the control group, owing mostly to an increase in abuse deaths among Whites and less to an increase among Hispanics. Death rates due to abuse decreased slightly among Blacks in the control group. Consistent with the results for deaths due to abuse in 1985-1998 (Table 4), the rates for 1987-1998 increased substantially for the treatment group and slightly for the control group. Again, inference regarding these rates must be tempered by the recognition of extremely low incidence rates. A relatively low number of occurrences of deaths due to abuse may have dramatic effect on overall death rates. The increases may be due to the influences identified in the previous group and be the result of either improved investigative techniques or increases in the event itself.

Table 7: 1989-1993 and 1994-1998 treatment and control groups, by gender, race, SIDS and Abuse (Rates per 100,000).

Category	Male Death Rate		Female Death Rate	
	1989-1993	1994-1998	1989-1993	1994-1998
Race / Treatment Group				
White	202.8	164.4	146.7	119.6
Black	454.8	219.5	366.1	162.5
Hispanic	687.3	254.8	285.6	193.5
Other	203.3	168.7	166.3	238.2
Total	387.1	201.9	241.1	178.4
Race / Control Group				
White	212.0	173.1	155.5	148.2
Black	345.5	318.5	262.9	399.7
Hispanic	195.4	210.9	171.4	138.2
Other	126.9	152.7	51.2	130.6
Total	220.0	213.8	160.2	204.2
Age Group / Treatment Group				
Birth – 11 months	1097.2	773.2	950.9	776.3
1-5 Years	53.3	38.0	41.0	28.9
6-10 Years	179.0	24.2	18.6	19.5
11-15 Years	443.4	43.6	146.4	26.6
16-17 Years	162.4	130.38	48.8	40.9
Total	387.1	201.9	241.1	178.4
Age Group / Control Group				
Birth – 11 months	867.9	860.3	682.7	694.6
1-5 Years	53.8	50.8	35.3	40.4
6-10 Years	30.5	26.4	17.2	212.5
11-15 Years	46.8	37.8	22.8	25.0
16-17 Years	100.8	93.9	43.1	48.4
Total	220.0	213.8	160.2	204.2
SIDS / Treatment Group				
White	102.4	89.4	57.9	55.8
Black	179.5	163.1	135.0	99.4
Hispanic	76.8	77.4	49.2	54.9
Other	42.6	17.6	17.3	46.8
Total	100.3	86.9	64.8	64.2
SIDS / Control Group				
White	132.2	103.0	81.2	87.1
Black	231.6	253.8	185.2	151.8
Hispanic	99.5	81.3	80.6	53.6
Other	42.7	66.3	.000	17.3
Total	126.5	126.1	86.7	77.4

The descriptive mean death rates for the for 1989-1993 and 1994-1998 group reflected an overall decline for both the treatment and control groups, except for an increase in overall female death rates in the control group. The

death rates for males and females in the treatment group declined overall and among all races except for Other females. Conversely, the death rates for males in the control group increased among Hispanics and Others and increased overall. The rates also increase for Black and Other females as well as overall for the control group. Males and females in all age categories in the treatment group, especially for 6-10 and 11-15 year old males and 11-15 year old females experienced an overall decrease. A decrease was experienced among all age groups and overall among control males. However, females in the 1989-1998 control group experienced an increase in all age groups, especially 6-10 year old, and overall. Treatment group death rates due to SIDS decreased overall and among males of all races except Hispanic, and females of all races except Hispanic and Others. Control group death rates also decreased overall for both males and females except for increased rates among Black males, Other males, White females and Other females.

Death rates due to abuse could not be presented in terms of age groups due to very low frequencies and are presented for the treatment and control groups 1989-1993 / 1994-1998 by race with both genders combined in Table 8.

Table 8: Mean death rates by gender and race for deaths due to abuse / treatment and control groups 1989-1993 and 1994-1998 (Rates per 100,000).

Race	Male and Female Death Rate (Abuse / Treatment Group)		Male and Female Death Rate (Abuse / Control Group)	
	1989 - 1993	1994 - 1998	1989 - 1993	1994 - 1998
White	2.47	0.07	0.07	2.33
Black	0.40	0.18	0.00	10.80
Hispanic	3.00	0.00	0.27	0.08
Other	0.00	0.00	0.00	0.00
Total	1.47	0.06	0.08	3.30

Contrary to the results identified for the previous two groups, the overall death rates among the treatment group declined. The death rate among the control group increased again, but unlike the previous two groups, increased substantially, owing greatly to a large increase in abuse death rates among Blacks. The 1989-1998 treatment group reflects a decrease among all races and overall in death rates due to abuse.

Results (Inferential)

All calculations were conducted using rates in order to compensate for differences in populations and present the data in comparable units of measure. Results to overall tests between control and treatment groups are presented as totals and by race. Select cause of death (SIDS and abuse) tests are presented without racial breakdown. Death rates were identified as occurring per 100,000 population within specified group. Testing for each group of years was conducted by first establishing the relationship between the treatment and control group for those years preceding the introduction of the CFRT as an intervention (Treatment vs. Control). Secondly, results are presented for testing the association between the mean death rates before and after intervention between the treatment group. Lastly, test results between the treatment group and the control group following intervention is provided. The intent is to establish the control group as a viable comparison group by using the first t-test comparison to determine whether there is no significant difference between the treatment and

control groups prior to intervention. The second test establishes whether there is a significant difference between mean death rates before and after the intervention, which necessarily can only be conducted within the treatment group. Finally, a t-test for difference in mean death rates between counties with CFRT representation (treatment) and counties without CFRT representation (control) is conducted. Results of the t-tests for 1985-1998 are presented in Table 9.

Table 9: 1985-1991 and 1992-1998 Results of t-tests treatment and control groups total and by race, SIDS and Abuse

Category Tested	T-test value	Confidence Interval	P-value
1985-1991 Treatment vs. Control (Male & Female)	.576	-72.39 - 132.29	.565
White	-.680	-273.72 - 134.63	.499
Black	.759	-182.12 - 405.77	.450
Hispanic	.085	-161.07 - 175.35	.933
Other	1.318	-36.53 - 177.30	.193
1985-1991/1992-1998 Treatment Group	3.655	34.68 - 115.03	.000
White	3.106	23.23 - 103.10	.002
Black	2.725	33.82 - 208.29	.007
Hispanic	2.205	5.60 - 96.91	.028
Other	4.070	33.08 - 94.81	.000
1992-1998 Treatment vs. Control (Male & Female)	-2.179	-49.15 - 2.59	.029
White	-1.992	-67.94 - -.49	.047
Black	-.172	-76.73 - 64.39	.864
Hispanic	-1.027	-58.69 - 18.38	.305
Other	-3.294	-73.26 - 18.52	.001
1985-1991 Treatment vs. Control (SIDS)	-1.727	-95.04 - 7.38	.091
1985-1991/1992-1998 Treatment Group (SIDS)	.851	-7.70 - 19.44	.395
1992-1998 Treatment vs. Control (SIDS)	-3.351	-39.77 - 10.34	.001
1985-1991 Treatment vs. Control (Abuse)	1.600	-.4119 - 3.33	.121
1985-1991/1992-1998 Treatment Group (Abuse)	-.626	-2.84 - 1.47	.532
1992-1998 Treatment vs. Control (Abuse)	2.345	.28 - 3.17	.020

In comparing the mean death rates of the 1985-1991 treatment group to the control group for the same time period, the t-test indicated no significant difference ($p=.565$), thereby establishing the two groups as viable comparison

groups. Further examination by racial group revealed no significant differences between any group. Comparison of the mean death rates for the equal number of years prior to and following the introduction of the CFRT (1992) indicates a significant difference ($p < .001$) with corresponding significant differences experienced by all races. Finally, testing the difference among mean death rates between the treatment and control groups for the years following the introduction of the five child fatality review teams (1992-1998) indicates an overall significant difference at the .05 level ($p = .029$). However, Black and Hispanic races do not reflect significant differences ($p = .864$ and $.305$ respectively). The difference between mean death rates due to SIDS are not found to be significant between treatment and control groups prior to intervention ($p = .091$), establishing these two groups as viable comparison groups. There is not a significant difference between pre and post intervention measures among the treatment group ($p = .395$). However, a highly significant difference is found between the treatment and control groups for the period following introduction of the CFRT ($p = .001$). The same pattern of significance is found when comparing mean death rates due to abuse for this time period. No significance is detected when comparing mean rates between treatment and control group prior to the CFRT ($p = .121$); no difference is detected between mean death rates among the treatment group when comparing mean rates for the periods before and after intervention ($p = .532$); but a significant difference is calculated between treatment and control groups for the years following intervention ($p = .020$).

Table 10: 1987-1992 and 1993-1998 Results of t-tests treatment and control groups total and by race, SIDS and Abuse

Category Tested	T-test value	Confidence Interval	P-value
1987-1992 Treatment vs. Control (Male & Female)	-.783	-63.67 - 27.35	.434
White	-2.184	-175.21 - 9.06	.030
Black	.352	-100.22 - 143.86	.725
Hispanic	.188	-68.96 - 83.53	.851
Other	-.944	-51.41 - 16.91	.321
1987-1992/1993-1998 Treatment Group	3.644	31.55 - 105.14	.000
White	3.075	26.31 - 119.84	.002
Black	1.809	-9.1494-217.05	.072
Hispanic	3.104	35.64 - 159.33	.002
Other	-1.549	-58.13 - 6.92	.122
1993-1998 Treatment vs. Control (Male & Female)	-3.380	-86.83 - 23.05	.001
White	-1.475	-75.53 - 10.83	.141
Black	-.184	-110.14 - 91.36	.855
Hispanic	-2.215	-107.20 - 6.34	.027
Other	-2.645	-88.39 - 12.97	.009
1987-1992 Treatment vs. Control (SIDS)	.683	-42.70 - 86.68	.498
1987-1992/1993-1998 Treatment Group (SIDS)	3.276	33.15 - 138.20	.002
1993-1998 Treatment vs. Control (SIDS)	-1.939	-77.75 - 1.36	.058
1987-1992 Treatment vs. Control (Abuse)	3.466	.60 - 2.21	.001
1987-1992/1993-1998 Treatment Group (Abuse)	3.414	.58 - 2.19	.001
1993-1998 Treatment vs. Control (Abuse)	-2.698	-5.62 - -.86	.008

A t-test conducted to determine whether there was a significant difference between the mean death rates of the 1987-1992 treatment group and the control group for the same time period indicated no significant difference ($p=.434$). This was true for all races except for Whites, which demonstrated a significant difference ($p=,.030$). This, however, established the two groups as viable comparison groups for continued testing. A significant difference was detected when comparing the mean death rates between the 1987-1992 and the 1993-1998 treatment groups ($p<.001$). This was true for all races except for Blacks and Others ($p=.072$ and $.122$, respectively). Finally, comparison between the

treatment group and control group for the period following the introduction of the CFRT (1993-1998) indicated a significant difference ($p=.001$). However, the difference was not significant for both Whites and Blacks ($p=.141$ and $.855$, respectively). Testing the differences between mean death rates due to SIDS resulted in there being no significant difference between treatment and control groups prior to intervention ($p=.542$), but there were significant differences between mean death rates before and after intervention among the treatment group ($p<.001$) and between the treatment and control group following intervention ($p<.001$). The t-test for examining differences between death rates due to abuse indicated similar significant differences within the treatment group before and after CFRT intervention ($p=.001$) and between treatment and control group following CFRT intervention ($p=.008$). However, there was also a significant difference between treatment and control group prior to the intervention as well ($p=.001$).

Table 11: 1989-1993 and 1994-1998 Results of t-tests treatment and control groups total and by race, SIDS and Abuse (Rates per 100,000).

Category Tested	T-test value	Confidence Interval	P-value
1989-1993 Treatment vs. Control (Male & Female)	.802	-74.25 - 175.8	.424
White	.026	-172.93 - 177.36	.980
Black	.489	-293.59 - 480.35	.628
Hispanic	.105	-216.01 - 239.59	.917
Other	1.037	-97.25 - 288.73	.313
1989-1993/1994-1998 Treatment Group	1.176	-50.77 - 197.56	.243
White	.436	-117.06 - 181.89	.665
Black	1.187	-172.20 - 615.32	.252
Hispanic	-.037	-230.89 - 222.53	.971
Other	.522	-124.84 - 212.42	.604

(Table 11, Continued)

Category Tested	T-test value	Confidence Interval	P-value
1994-1998 Treatment vs. Control (Male & Female)	.580	-103.56 - 56.46	.563
White	.333	-138.08 - 98.73	.741
Black	-.892	-329.93 - 127.98	.378
Hispanic	.267	-151.80 - 198.56	.790
Other	.010	-129.61 - 128.26	.992
1989-1993 Treatment vs. Control (SIDS)	-2.074	-170.79 - 3.66	.059
1989-1993/1994-1998 Treatment Group (SIDS)	-1.562	-59.57 - 7.69	.127
1994-1998 Treatment vs. Control (SIDS)	-1.477	-59.05 - 8.95	.145
1989-1993 Treatment vs. Control (Abuse)	-1.368	-.32 - 7.615	.199
1989-1993/1994-1998 Treatment Group (Abuse)	-.650	-9.52 - 4.90	.520
1994-1998 Treatment vs. Control (Abuse)	.730	-3.02 - 6.47	.469

The t-test conducted to determine whether there is a significant difference between the mean death rates of the 1989-1993 treatment group and the control group for the same time period indicated no significant difference ($p=.424$).

However, in a departure from previous tests, the mean death rates among the treatment group for the period of time before the advent of the CFRT (1989-1993) and the period of time after the initiation of the CFRT (1994-1998) is also not significant ($p=.243$). Lastly, comparison of the mean death rates between treatment and control groups for the period following the introduction of the CFRTs (1994-1998) was not significant ($p=.563$). Similarly, although comparison of mean death rates due to SIDS between treatment and control groups prior to intervention was found not significantly different ($p=.059$), subsequent tests comparing the treatment group before and after intervention and the treatment group to the control group following intervention were both found not significantly different ($p=.127$ and $.145$ respectively). The same scenario was reflected when testing for differences among mean death rates due to abuse. The comparison

of the treatment and control group prior to intervention was found not significant ($p=.199$). Ensuing tests among the treatment group before and after intervention and between the treatment group and control group after intervention were both found to be insignificant ($p=.520$ and $.469$ respectively).

Table 12: Results of ARIMA interrupted times series analysis:

Relationship Tested	Covariance Matrix	T-ratio	Probability
Teams Initiated in 1992	.00177	3.27	.001
Teams Initiated in 1993	.00419	1.74	.083
Teams Initiated in 1994	.01269	1.31	.193
Teams Initiated in 1992 (SIDS)	.01886	1.12	.269
Teams Initiated in 1993 (SIDS)	.02038	0.55	.588
Teams Initiated in 1994 (SIDS)	.02802	1.19	.242
Teams Initiated in 1992 (Abuse)	.01881	0.35	.724
Teams Initiated in 1993 (Abuse)	.02003	0.42	.673
Teams Initiated in 1994 (Abuse)	.02704	0.42	.679

According to the autoregression integrated moving averages test, only the teams initiated in 1992 demonstrated a significant deviance from the expected declining trend in overall death rates given the interruption of representation by a CFRT. Teams initiated after 1992 (e.g., 1993 and 1994) do not reflect a departure from mean death rates significantly different than predicted by the trend established prior to representation by a CFRT. The ARIMA test did not indicate significant differences between treatment and control groups when isolating SIDS and deaths due to abuse given the interruption of representation

by a CFRT. The only statistically significant difference indicated by the ARIMA analysis is that overall death rate trends for all races and genders combined between the treatment and control groups for 1989-1998 were lower in the post-intervention period than would have normally been expected.

Table 13: Odds Ratio, 95% Confidence Intervals, Chi-Square and P-values for treatment and control groups comparisons - all causes:

Year	Group	Odds Ratio	95% CI	Chi-Square	P-value
1985-1991	Treatment / Control	0.88	.73-1.06	1.95	0.16
1985-1998	Treatment	1.44	1.18-1.76	13.52	0.0002
1992-1998	Treatment / Control	1.15	0.93-1.42	1.84	0.17
1987-1992	Treatment / Control	1.04	.86-1.25	0.15	0.7
1987-1998	Treatment	1.50	1.2-1.87	13.7	0.0002
1993-1998	Treatment / Control	1.40	1.12-1.75	9.1	0.003
1989-1993	Treatment / Control	0.80	.66-.97	5.64	0.01
1989-1998	Treatment	1.42	1.16-1.73	12.68	0.0003
1994-1998	Treatment / Control	1.14	.92-1.42	1.55	0.21

Consistent with the results of the t-test, the 1985-1991 treatment and control groups for children's deaths due to all causes did not reflect a significant difference (OR=0.88; CI: .73 - 1.06; Chi-square=1.95, p=0.16). The treatment group reflected a significant difference between 1985-1991 and 1992-1998, with an odds ratio of 1.44 (CI: 1.18 - 1.76) and a highly significant chi-square p-value of 0.0002. However, unlike the t-test comparison of the post intervention difference between the treatment and control group (1992 - 1998), no significant difference was found (OR=1.15; CI: 0.93 - 1.42; Chi-square=1.84; p=0.17).

Comparison of the 1987-1992 treatment and control group (prior to intervention) indicated no significant difference (OR=1.04; CI: .86 - 1.25; Chi-square=0.15; p=0.7) thereby establishing these two groups as comparably viable. The treatment group demonstrated a very significant difference between before (1987-1992) and after intervention (1993-1998) groups (OR=1.50; CI 1.2 - 1.87; Chi-square=13.7; p=0.0002). Comparison of the treatment and control groups following the initiation of the CFRTs (1993-1998) also indicated a very significant difference (OR=1.40; CI: 1.12 - 1.75; Chi-square=9.1; p=0.003).

The 1989-1993 treatment and control groups were found to be significantly different prior to intervention (OR=0.80; CI: .66 -.97; Chi-square=5.64; p=0.01). The ensuing test for difference in the treatment group before and after intervention indicated a very significant difference having taken place based on time periods separated by the introduction of the CFRT. (OR=1.42; CI: 1.16 - 1.73; Chi-square=12.68; p=0.0003). However, comparison of the treatment and control group following the initiation of the CFRT (intervention) did not indicate a significant change (OR=1.14; CI: .92 - -1.42; Chi-square=1.55; 0.21). Curiously, the 1989-1998 treatment group reflected a protective effect after intervention between the treatment and in comparison to the control group (OR=1.4 and 1.4 respectively; both significant at <.005 level) but indicated a negative effect within the treatment group for the period before intervention (OR=.80; CI .66-.97 and therefore statistically significant). The overall effect was extremely similar to that represented by the 1985-1998 group.

Table 14: Odds Ratio, 95% Confidence Intervals, Chi-Square and P-values for treatment and control groups comparisons - Sudden Infant Death Syndrome:

Year	Group	Odds Ratio	95% CI	Chi-Square	P-value
1985-1991	Treatment / Control	1.53	1.15-2.04	9.23	0.002
1985-1998	Treatment	1.08	.78-1.49	0.23	0.635
1992-1998	Treatment / Control	1.33	.98-1.80	3.46	0.06
1987-1992	Treatment / Control	0.85	0.67-1.09	1.74	0.186
1987-1998	Treatment	2.31	1.71-3.12	33.6	0.000
1993-1998	Treatment / Control	1.57	1.14-2.17	8.2	0.004
1989-1993	Treatment / Control	2.65	1.9-3.7	37.97	0.000
1989-1998	Treatment	0.66	.46-.96	5.28	0.02
1994-1998	Treatment / Control	1.33	.98-1.8	3.49	0.06

The 1985-1991 and 1989-1993 comparisons between treatment and control groups prior to intervention resulted in significant differences, therefore not qualifying these two groups as viable comparison groups. However, post-intervention calculation did not indicate a significant difference (OR=1.33; $p=0.06$). This is in contrast to the t-test conducted for the 1985-1998 groups. Conversely, consistent with the t-test, the 1987-1992 pre-intervention test did not indicate a significant difference and therefore validated these two groups as viable comparison groups. The ensuing post-intervention calculations indicated a significant difference between these two groups with an odds ratio of 1.57 ($p=0.004$).

No odds ratio or chi-square calculations were feasible in regards to the data for deaths due to abuse due to extremely low incidence. The total numbers for these deaths, as well as overall frequencies and rates, are presented in Appendix B.

Summary

Descriptive analysis of children's death rates for all causes for the time period 1985-1998 indicated that among those five counties where a CFRT was initiated in 1992, death rates declined for all races and genders except White males and among all age groups except 16-17 year olds. Conversely, in the control group for the same period, death rates increased in Blacks and Other races for both males and females. In comparing age groups, the treatment group experienced a rise in death rates only among males in the 16-17 year old category. The control group, however, reflected increases in 1-5 year old males, 6-10 year old males, 16-17 year old males, 1-5 year old females, and 6-10 year old females. In all year groups, for both genders, the rates were higher in the treatment group. Comparatively, the percentage and degree of change between death rates for the periods 1985 - 1991 and 1992 - 1998 was higher among the treatment group than the control group.

Inferential testing by t-test for this group (1985-1998) indicated that although there was no difference between the two groups prior to intervention, there was a significant difference between the treatment and control groups following intervention marked by the initiation of the CFRT. There was also a significant difference within the treatment group before and after intervention. However, Blacks and Hispanics did not reflect a significant difference between areas that were and were not served by the CFRT. This overall effect was corroborated by the ARIMA test that indicated the decline in death rates after the

introduction of the CFRTs exceeded that which would otherwise be predicted in those counties with CFRT representation. However, although odds ratio calculations indicated that children died 1.15 times more in counties without CFRT representation in the 1985-1998 group, this particular difference was not found to be statistically significant. This was also corroborated by chi-square testing. Regardless, the researcher interprets these results as indicating a significantly protective effect based on the strong t-test results and the results of the ARIMA test.

Descriptive analysis of children's deaths due to SIDS for the time period 1985-1998 indicated that among the five counties represented by a CFRT death rates declined overall and among all races for both genders except for Hispanic males and females and "Other" race females. For the same time period, among those counties without CFRT representation, a decrease for deaths due to SIDS was also experienced overall for both males and females. However, rates increased among Black males, Other males, White females, and Other females. Consistent with death rates due to all causes, inferential analysis for SIDS in 1985-1998 indicated that the difference between the treatment and control groups was not significant prior to intervention but was significantly different for the period following the introduction of the CFRT. This is further corroborated by the post intervention findings by odds ratio calculation and chi-square testing. Although these tests also indicated a significant difference prior to intervention,

the risk of death dropped from 1.53 to 1.33. No difference was determined by the ARIMA test for overall deviance of SIDS death rates from expected parameters.

Descriptive analysis of death rates due to abuse for the period 1985 - 1998 reflected an overall increase in death rates between the treatment and control groups for both genders. Inferential statistics indicated that mean testing resulted in a significant post-intervention difference whereas no difference was identified prior to intervention. This is consistent with the researcher's speculation that multidisciplinary review exposes greater instances of deaths due to abuse. This inference, of course, requires further examination. ARIMA testing did not indicate a pre and post test difference between groups.

Descriptive analysis of children's death rates for all causes for the time period 1987-1998, indicated that among both counties with CFRT teams initiated in 1993, death rates in the treatment group decreased overall for both males and females and among all races except for White and Other females. In the control group for the same time period, death rates increased for females overall and among Hispanic males, Other males, and significantly for Black females. The treatment group also experienced declining death rates in all age groups except 6-10 year old males, 16-17 year old males, and 6-10 year old females. The control group experienced increases in the death rates among birth-11 month old females, 6-10 year old females, 11-15 year old females, and 16-17 year old females. Again, the overall impression is that decreases in death rates are greater in counties with CFRT representation.

Inferential analysis indicated no significant difference for deaths due to all causes between the treatment and control groups prior to the introduction of the 1993 CFRT. However, a significant difference was experienced between the treatment and control groups following intervention, although both Whites and Blacks in these groups were found not to have experienced a significant difference. Although close at a probability value of .083, the ARIMA test did not corroborate this difference at the designated .05 level of significance. Odds ratio calculation indicated that children in the control group had 1.4 times the death rate of children in the treatment group. This test was significant, especially since the two groups were not found to be significantly different prior to intervention. This was further corroborated by the results of the chi-square test. Inference regarding these results, although supporting those found for the first group, must be tempered by the fact that the treatment group consisted of only two counties.

Deaths due to SIDS for the period of 1987-1998 were described as decreasing overall for both males and females in the treatment group, with declines in both males and females occurring among all races. Females in the control group experienced increases in death rates due to SIDS among Whites and Others whereas control males experienced increases among Blacks and Others.

T-testing of the differences between the two groups indicated no statistical difference in death rates due to SIDS between the two sets of counties prior to the introduction of the CFRT. However, post-intervention testing resulted in the

groups barely not indicating a statistically significant difference ($p=0.058$). The ARIMA test did not indicate a significant departure from the expected trend. However, the odds ratio calculation and chi-square test indicated that there was actually a significant protective effect in the treatment group whereas a negative effect existed prior to intervention (not statistically significant). Given the transition from a negative effect to a protective odds ratio of 1.57, the researcher interprets these results as consistent with those of the 1985-1998 group and suggests that the CFRT has a protective effect on death rates due to SIDS among teams initiated in 1993.

Statistical description of children's deaths due to abuse for the period 1987-1998 indicated that death rates increased overall for the treatment group owing entirely to a substantial increase in abuse death rates among Blacks. White and Hispanic children demonstrated decreases. The control group reflected a slight overall increase in death rates for this period, with rates increasing for Whites and Hispanics and decreasing for Blacks. The findings for both the treatment and control groups are consistent with the result of the 1985-1998 group. This is further consistent with the speculated effect of the CFRT on determination of deaths due to abuse. A t-test of the relationship between treatment and control groups did not indicate a viable comparison between groups prior to intervention although reflecting a similarly significant difference following the introduction of the CFRT. No significant deviation from expected parameters between pre and post intervention was identified by the ARIMA test.

Descriptive analysis of children's death rates for all causes for the time period 1989-1998, indicated that among counties with CFRT teams initiated in 1994, overall death rates declined for both males and females in the treatment group although an increase was experienced by White males. Conversely, death rates increased overall for both males and females in the control group with increases occurring among Hispanic males, Other males, Black females, and Other females. A decline among death rates occurred in all age groups for males and females in the treatment group for this time period. Increases occurred in the control group for Birth-11 month old males, 1-5 year old males and 6-10 year old females.

Inferential t-test analysis indicated that although there was not a significant difference between treatment and control groups prior to the initiation of the CFRT in 1994, there was also not a significant difference for the period following the intervention. This is substantiated in the ARIMA test, the odds ratio and chi-square tests. The latter test indicated a significant difference prior to intervention but no difference thereafter.

The description of the data for SIDS deaths in the 1989 -1998 treatment group indicated an overall decline in death rates for males and females, but slight increases among Hispanic males, and Other females. The control group for this time period also experienced an overall decline in death rates with increases among Black males, Other males, White females and Other females. A t-test of this relationship indicated that no significant difference existed prior to or after

intervention. The ARIMA test also did not indicate that the trend after intervention deviated significantly from predicated parameters. The odds ratio and chi-square test demonstrated a significant difference before and after the intervention.

Overall death rates due to abuse for the period 1989-1998 declined among the treatment group and for all races, and increased overall and for all races except Hispanics in the control group. The t-test conducted indicated no difference before or after intervention. Lastly, no deviance from expected parameters was indicated by the ARIMA test.

CHAPTER V

CONCLUSION

The results of the analysis indicate that the Child Fatality Review Teams (CFRT) in Texas have a quantifiable impact on the overall death rates of children suggesting that this effect is dependent on the maintenance of these teams over the longer term. The CFRTs initiated in 1992 and 1993 indicated that the differences in mean death rates, although not different prior to the introduction of the teams, were significant thereafter. The teams initiated in 1992 were also the only group to demonstrate a decrease in death rates in excess of what was predicted by the ARIMA model. The odds ratios calculated for the 1992 and 1993 teams reflect a protective effect. Although the 1992 test was not established as statistically significant, it warrants mention that the chi-square test and odds ratio calculations only compare proportional differences and are not reliant on sample size. Further, the strength of the ARIMA result provides strong support regarding the inferred effect of this group.

The inferential test conducted in consideration of the CFRTs initiated in 1993 also indicated a protective effect as evidenced by a statistically significant result when comparing mean death rates prior to and preceding the introduction of the CFRT. This was corroborated by calculation of odds ratios and chi-square

statistics but not the ARIMA, which may reflect this test's reliance on longer periods of consideration.

The 1989-1998 group did not demonstrate a similar decline in death rates. This indicates that perhaps the effect inferred by the two prior groups may not have had a chance to adequately develop over the time available for this group.

The select causes of death, Sudden Infant Death Syndrome (SIDS) and deaths due to abuse reflected supportive results. As suspected by the researcher and consistent with the results of analysis of death rates due to all causes, SIDS demonstrated a significant difference for the CFRTs initiated in 1992. But this difference was found to be marginally insignificant for the groups defined by 1993 CFRTs. Consistent with the results for all causes, the last group, with teams initiated in 1994, did not demonstrate significant post-intervention differences between the treatment and control group. Significant results for SIDS testing indicated a protective effect on the part of the CFRT, suggesting a decline in SIDS deaths or enhanced accuracy in determining infant causes of death.

Descriptive statistics consistently indicated large death rates among infants (birth through 11 months). To ensure the integrity of the analysis, the researcher investigated whether the significant result found for SIDS death rates in 1992 may have also contributed for the significant result found for death rates due to all causes for that time period. Review of the proportion of SIDS deaths in terms of overall deaths for the 1992 treatment group and the 1992 control group

indicated a difference of 0.8%. This difference did not indicate that a significant influence on the overall findings could be attributed to SIDS deaths.

Deaths due to abuse also demonstrated significant differences between the treatment and control groups for the groups marked by 1992 CFRT representation. The 1993 groups were also found to be significant following intervention, although the pre-intervention comparison between the treatment and control groups were also significant. Further, the direction of the effect indicated that treatment groups identified more deaths due to abuse among counties with CFRT teams initiated in 1992 and 1993. These findings are consistent with the results established for deaths due to all causes and SIDS for these two time periods. Lastly, no significant effects were found for the teams initiated in 1994. Consistent with the researcher's speculation, review of the descriptive statistics indicated an increase in the determination of deaths due to abuse in the 1992 and 1993 groups. This may again indicate that the effect of the CFRT is dependent on the longevity of the team's operation. Inference regarding deaths due to abuse must be made cautiously due to the low frequencies and the extreme effect incidents have on overall rates.

Discussion

The health and wellbeing of children is increasingly a priority for developed countries. The overlay of resources and information afforded by child fatality review teams (CFRT) is an essential mechanism towards the prevention

of avoidable deaths. Owing their origins to the fight against child abuse and later Sudden Infant Death Syndrome (SIDS), the CFRT teams exemplified the assimilation, analysis and dissemination of accurate data necessary to generate effective interventions. The association between these interventions and the impact on incidence rates, however, has been mostly intuitive and speculative. The contemporary paradigm for performance outcome measures insists on quantitative associative measures. This contributed towards the justification of this study.

A review of the literature, a national survey and the researcher's own observations indicate that the CFRT is an essential component in the effort to decrease the incidence of preventable child mortality. The preventative mission of the CFRT personifies the rudimentary concepts of public health. As per the guidelines for public health and epidemiological research, the collection of accurate data underpins the CFRT process. The interaction of professionals connected to each case from medical, legal, child protective, social and investigative perspectives promotes accuracy not otherwise possible by any individual reporting or investigative source.

Assurance of accuracy is closely related to ensuring the consistency and standardization of the process for collection and dissemination of this data. Repeatedly, respondents to the national survey identified the need for state and national standardization. The survey respondents from Nebraska, South Dakota, Wyoming and 11 other states stressed the need for standard investigative and

reporting procedures throughout their own state and between states on a national level. The literature corroborates the essential nature of standardization as an integral component of any comprehensive review process. A consistent, standardized format for reviewing all children's deaths will enhance the ability to collect accurate and comparable data thereby heightening the likelihood of developing effective interventions.

Based on the responses from the survey respondents, admittedly only representing slightly over half of the states in the country, 59% of the teams covered the whole state, 52% were mandated to review cases by law, 70% reported standardization and 37% reviewed all children's deaths. The high percentage of states reflecting a system of standardization indicates the inherent prioritization of standardized systems for child fatality review. Texas also struggles with the inconsistencies between review teams. However, a sense of standardization is reflected through the centralized efforts of a state team.

The attributable effect and impact of the CFRT process must be established in order to effectively advocate for development of uniform programs throughout Texas and the United States. Not only is this association integral to an appropriate outcome measure, but there is urgency in establishing the impact of the CFRT based in their very existence. The Centers for Disease Control and Prevention midcourse review for Healthy People 2000 released in 1995 indicated that due to decreasing rates of some violent crimes, "the number of states with unexplained child death review systems has declined." The number has since

risen. However, this inclination on the part of state and local teams is not uncommon. The amount of time required on the part of professionals from a myriad of fields incurs a real cost in terms of time, money and resources pulled away from their primary occupations. Perhaps the indications of success are interpreted as justification to decrease the priority of attendance. The local Tarrant County team, one of the first teams in the nation, has itself experienced diminishing attendance and there have been suggestions of disbanding the team altogether. These suggestions further contributed to the urgency of this study.

The effectiveness of the CFRT effort is reliant on a proactive, preventative perspective afforded through maintaining the CFRT on a constant basis. Death rates for children are dropping among most age groups and races. However many, if not most, of the deaths that do occur are preventable and further underscore the need for ongoing child mortality review. As stated by Friedrich,

“The health of American children has increased throughout this century and there has been a decline in deaths due to a number of factors, but we’ve also experienced growth in preventable deaths; that is, deaths due to intentional injuries, homicides, suicides. The top three causes of death for all American children are unintentional injuries (41%), which include motor vehicle accidents, drowning and accidents in the home; homicide (14%) and suicide (7%). Of these causes of death, a large percentage are preventable and so this is a public health problem that we need to

understand better so we can develop a series of strategies to prevent these incidents.”⁶⁶

Kovitz et al. identified the multidisciplinary team as essential to accuracy in reporting, case management and intervention. However, he added that it was evident that to ensure the effectiveness of the team, membership and resources required constant maintenance and orchestration.⁸⁷

No literature was found that describes a comparable attempt to analyze the impact of the CFRT process. A study conducted by Gellert et al. compared the demographic determinants between those cases reviewed and not reviewed by a multidisciplinary team. Their findings indicated substantial differences between the specific and general description of at-risk populations based on whether children's deaths were reviewed by a multidisciplinary group.⁹⁹ Although Gellert did not pursue the analytical question posed by this study, his results identified a change in the description of the research population based entirely on multidisciplinary representation. Similarly, the analysis conducted in this study indicates that there are differences between counties marked by CFRT representation. The difference explored by this study, however, pursued the somber, but crucial issue, of multidisciplinary representation of children's death rates.

The merit of attempting to isolate the effect of the CFRT was questioned by survey respondents from Virginia, Colorado and six other states, including the survey respondent from Pennsylvania, who questioned the pursuit of this

analysis only to be contradicted in the state's Annual Report. However, the majority of survey respondents, professionals involved with the child fatality review process across the nation, supported the analysis undertaken by this study. Justification and support for this study was further evidenced by over half of the survey respondents expressing an unsolicited interest in the process and results of this study. Several survey respondents indicated that they would use this information to conduct a similar investigation in their own state.

The lack of literature specific to the CFRT indicates that the CFRT is in its founding stages. Repeatedly, there has been evidence that the CFRT is the most viable vehicle for the determination and collection of accurate data to generate effective interventions and responses in response to preventing children's deaths.⁸ The study by Onwauchi-Saunders and comments by the survey respondents from Georgia, California, Oregon and six other states indicate that analysis had been conducted establishing the effectiveness of the CFRT. Although intuitively sound, the associations were insinuated and speculated rather than scientifically established. Establishing an empirical association between the CFRT and children's death rates is a pursuit unique to this study.

The researcher sought to quantify the relationship between representation by a CFRT and death rates among children. To clarify such an illusive objective, determination of select causes of death were also evaluated. Traditional reliance on clinical, hospital and death records has consistently been demonstrated as

suspect. Most studies agree that the multidisciplinary forum is the most reliable means of collecting accurate data. Child death review teams have repeatedly used the multidisciplinary review process to determine causes of death that would otherwise have been mistakenly recorded.¹⁰⁰ Misclassification consequently affects the data used to generate interventions. Schloesser et al. demonstrated that by accurately monitoring and recording deaths of infants and young children, effective public policy is developed.¹⁰¹ A decline in SIDS deaths may indicate that the "Back-to-Sleep" program has resulted in fewer deaths or it may indicate that the process of the CFRT, including such activities as death scene investigation protocol, has resulted in recording these deaths as accidental asphyxia or some other cause. Lastly, though, the determination of SIDS and deaths due to abuse are two causes of death that most benefit from CFRT discourse. Efforts at educating parents regarding the sleep position of their baby were orchestrated in the mid-nineties, squarely in the midst of the study period. The effect of this intervention along with a heightened awareness of children's deaths is difficult to extract from the effect of an interdisciplinary review process.

The CDC estimates that child abuse is responsible for the death of 5.4 out of every 100,000 children. However, the CDC further estimates that due to misclassification, this figure should be 11.6 children out every 100,000. The most common scenario, deaths due to abuse at the hands of caretakers and parents, is relatively new. Dr. John Caffey first identified this phenomenon in 1949 as what he mistakenly referred to as "parent-infant death syndrome".

Thankfully, both understanding and recognition of child abuse has greatly improved in large part due to review by multidisciplinary representation.¹⁰¹

L'Hoir, Henderson-Smart, and Willinger all support the review process for identifying deaths due to SIDS and abuse. The review process, either by directive or as a by-product of the CFRT process itself, promotes autopsies in children that enhance the accuracy of cause of death determination. The review team also contributes to uncovering incidents of abuse otherwise undetected. Unexpected deaths and deaths of undetermined origin require a complete review, usually including an autopsy, for accurate determination of cause of death. Deaths due to diseases of the respiratory system and digestive system, as is often the case with children, have frequently been mistakenly diagnosed without an autopsy.⁹

It is undeniable that the CFRT is a worthwhile endeavor. However, the research question is not whether the CFRT is worthwhile, but whether it is effective. As reported by the Ewigman and Armstrong studies, the interplay between medical, legal, law enforcement and social service agencies has resulted in identifying deaths due to abuse that were originally otherwise recorded. The autopsies mandated by the review team have resulted in SIDS cases being determined as due to other causes. There is some argument towards the inevitable influence of SIDS and abuse prevention programs regardless of CFRT representation. However, the analysis has not been able to completely isolate this effect, but the researcher suggests that the vehicle for the

implementation and dissemination of educational and other intervention programs has been mobilized by the process and personnel of the CFRT itself.

Based on its success with infectious diseases, reduction of smoking, motor vehicle injuries and a slew of other accomplishments, the public health model holds promise in effectively addressing the complex problem of preventable children's deaths. The public health model uses the principles of epidemiology to focus on and examine the root causes or factors that contribute to children's deaths, provides for a multidisciplinary scientific approach specifically directed toward identifying effective approaches to prevention and emphasizes outcome-based evaluations of interventions. Further, the CFRT approach personifies all of the essential public health services as identified by the American Public Health Association. These include (regarding CFRT):

- ◆ Maintaining surveillance on the incidence and causes of children's deaths through comprehensive review and reporting.
- ◆ Organizing and mobilizing community partnerships to help impact the incidence of children's deaths.
- ◆ Provision of accurate insight and data regarding those factors contributing to children's deaths.
- ◆ Education to the community through the various disciplines represented by the CFRT on the causes and preventive strategies to prevent children's deaths..

- ◆ Promotion of laws and regulations targeting factors contributing to preventing children's deaths.
- ◆ Linking resources to under-served or unserved populations to promote prevention of children's deaths.
- ◆ Assurance that the workforce investigating children's deaths are competent.
- ◆ Evaluation of effectiveness of public health efforts and interventions towards preventing children's deaths.
- ◆ Research for new insights and innovative solutions to impact preventable children's deaths.
- ◆ Develop policies and plans that reinforce prevention efforts towards diminishing those deaths of children that are preventable.

A perspective that may have an effect on the influence of interventions on mortality rates is the composition of a population as rural or urban. The current epidemiology of pediatric injury-related deaths in rural areas indicates that rural pediatric injury-related deaths have changed. Further, access to health care and the dissemination of information and educational programs is qualitatively and quantitatively different in rural areas. These attributes certainly have implications for public health education and injury/mortality control strategies in rural areas.¹⁰²

For the purposes of this study, a rural area was defined as a county that has a population of less than 50,000 people. This was established by using the Texas Department of Health Center for Rural Health Initiatives' definition of a rural county as any county that does not meet designation as a Metropolitan

Statistical Area (MSA).¹⁰³ The difference between rural and urban representation in the treatment and control group used in this study were not found to be significantly different except for the 1987-1998 group wherein both counties in the treatment group were classified as urban.

Pursuit of analysis based on rural and urban designation was not pursued by this study as it is considered a viable study in itself. According to designation by MSA and rural counties, there are extensive influences that may be explored. Some rural counties lay adjacent to urban counties and have potential access to urban resources. Rural counties in Texas are further distinguished as "frontier" counties if the population is less than 7 people per square mile. Additionally, in Texas, nine out of ten rural counties contain Medically Under-served Areas. One out of four rural physicians is nearing retirement age. Individuals injured in rural automobile accidents are three times more likely to die than those injured in an urban area. Finally, infant mortality rates are generally higher in rural areas. Consideration of these issues in terms of the difference between urban, rural and "frontier" counties and child fatality rates warrants a separate study.¹⁰⁴

In summary, the inferential tests for the counties which have had CFRT representation for the longest period of time, those established in 1992, indicated that the CFRT has had a protective effect on the death rates of children for all causes and for deaths due to SIDS. The analysis further indicated that more abuse cases were being recorded among counties with CFRT representation. The comparison of the means of death rates prior to intervention did not indicate

any difference, but significant differences were detected in the years following the advent of the CFRT. The 1992 group was also the only group that exceeded those parameters predicted for the ongoing decline in death rates by the ARIMA test. The odds ratio and chi-square was not found to be significant, but these tests are based on proportions and simple comparisons of means and not reliant on sample size. Lastly, the odds ratio, although not statistically significant, indicated that the treatment group went from having a negative effect of .88 prior to intervention to a protective effect of 1.15 following intervention. Therefore, a strong case can be made for the overall protective effect inferred by the analysis for this group.

Inference for the second group also suggests a protective effect. Testing between means indicated a significant effect among the treatment group and before and after intervention between the treatment and control group. All but the ARIMA test confirmed this difference as significant. These results were consistent for comparison of death rates for all causes and SIDS. Deaths due to abuse were significant both before and after intervention, but were consistent with the results of the previous group. The ARIMA test did not confirm these results and may have been affected by the short period of time under consideration, which is an essential element for the reliability of the ARIMA test.

The last period of time under consideration did not indicate results suggesting a significantly protective effect. Although descriptive statistics indicated a reduction in rates, inferential statistics did not suggest a significant reduction in

death rates. This may be attributable to the brevity of the period of time under consideration. In the case of the last group, the effect represented by the introduction of the CFRT was only five years.

The results of this study indicated that maintenance of a CFRT over at least six and preferably seven years might have a protective effect on the children's death rates and increase the accuracy of investigation and reporting. Indications from nation-wide survey respondents indicated support for state and national standardization of the CFRT system. This would allow direct comparison between states and facilitate evaluation. Further, the majority of respondents to the national survey indicated support for the analysis pursued by this research. The researcher suggests that the results of this study indicate support for establishment of a standardized child death review process within states and across the country. Such a process would establish a nationwide protocol for the investigation, review and reporting of children's deaths and provide consistent guidelines for analysis of outcome evaluations. Finally, these efforts, grounded in the CFRT process, would promote the most efficient means of establishing interventions that have a protective effect on the preventable deaths of children.

Recommendations

This study represents a unique perspective in developing performance outcome measures for the impact of child fatality review teams (CFRT). As a

heretofore-unexplored endeavor, several insights and observations are suggested by the researcher for future research recommendations.

A basic recommendation involves the collection of data and development of analysis protocols for ensuing studies. The Epigram database currently maintained by the Texas Department of Health could be improved by making the data translate electronically from the database to generally acceptable statistical programs. The database should also include additional variables in order to isolate overall and specific profiles of the children dying both from general causes and from select causes, such as SIDS and abuse. This includes extensive demographic information on victims and their parent. These may involve specific topics of information depending on the suspected cause of death such as information whether the parents smoked and what position was the child found when investigating suspected SIDS cases and expanded medical and social data when inquiries are focused on possible abuse.

Continued collection of data into the future is essential for the effective use of analytical procedures such as ARIMA. Given the results of this study, it is curious whether in an additional year, the 1989-1998 data becomes similar to the data currently reflected for 1987-1998. Also, the strength of the ARIMA analysis is best served with longer temporal periods of consideration. The researcher also recommends investigation of a cumulative analysis of the effect of the CFRT, although this may not be possible due to the need to indicate the initiation of the intervention. Ongoing efforts to isolate the effect of the CFRT in light of

multitudes of other contributing variables continues to be a daunting challenge and is encouraged through further study.

The feedback garnered from the national survey indicates support for standardization of the CFRT process across the state and country. This includes standardization of death scene investigation protocols, review processes, reporting procedures, and, as indicated by the interest in the results of this study, impact analysis and outcome performance evaluations.

The 1992 Senate Report #102-104 and House Report #102-121 recommended that the Interagency Panel on Sudden Infant Death Syndrome (SIDS) review and establish an updated standard death scene investigation protocol for scene investigation of unexplained infant deaths. As a result of the recommendation, the Centers for Disease Control and Prevention (CDC) Division of Reproductive Health (DRH), and the National Institute for Child Health and Human Development (NICHD) organized a workshop entitled "Workshop on Guidelines for Scene Investigation of Sudden Unexplained Infant Deaths," which was held in Rockville, Maryland, on July 12-13, 1993. The goal of the workshop was to gather information and ideas that could be used to establish guidelines that could be useful in developing a model death scene investigation protocol. The workshop was successful in generating a variety of recommendations and ideas concerning the desirable attributes of a protocol including essential items of data, identification of certain training needs, specification of procedures for data collection, reporting, and quality assurance, and proposed strategies for

implementation. This information can be used as a model to develop a standardized scene investigation protocol for sudden unexplained children's deaths.¹⁰⁵

The CFRT can serve to mobilize most of the program designed to impact the incidence of children and infant deaths. In regard to SIDS, a standardized CFRT program is an excellent vehicle for assimilating the information necessary to initiate effective interventions. Both Willinger and Randall et al. mention that since the recommendation in 1992 to place healthy infants on their back or side to sleep, the fraction of infants sleeping prone in the United States has decreased to approximately 43%. Both researchers advocate state legislation that supports autopsies for sudden unexpected deaths in children, and the establishment of state child fatality investigation and review teams . They identify local, regional, or state infant and child death review teams as an excellent mechanism for identifying risk factors for infant and childhood deaths along with establishing a conduit for effecting preventive measures to reduce the number of preventable deaths among children.^{73,105}

Kairys et al. unequivocally states that,

"No uniform system for the review of children's deaths exists for investigation in the United States. Review of the death of a child that is traumatic, unexpected, obscure, suspicious, or otherwise unexplained in a child younger than 18 years old requires a standardized scene investigation, autopsy and reporting procedure. Review of these deaths

requires pediatricians and other professionals, usually in the form of a child death review team."⁶³

The Houston child fatality review annual report states that approximately 4000-5000 children die annually in Texas and no single agency tracks these deaths nor assesses the circumstances surrounding those deaths.

Unfortunately, it is the circumstances that frequently determine the cause of children's deaths. Many agencies have a role in responding to a child's death, but there is no system for evaluation of risk factors. As a result, the report concludes,

"we know little about why children are dying in our state. By identifying risk factors, policies can be developed and funds targeted to address prevention initiatives. Better clarification of the factors contributing to a child's death is beginning to be addressed through the review process."⁴

Nationally, the efforts of the CFRTs are being recognized as assisting in the prevention of children's deaths. However, thorough examination of records of the National Center for Child Fatality Review did not indicate that any attempt has been made to quantitatively assess the impact of CFRT efforts.¹⁰⁶ Therefore, one of the main recommendations of this researcher is to continue to develop the ability to quantify and assess the impact of the CFRT and its individual components and programs.

A limitation of this study is the ability to generalize the findings. Fatality trends have historically been unpredictable with accidental deaths remaining the

only relatively constant variable. Geographic and regional differences in allocation of resources and prioritization of issues can also influence child fatality rates and effectiveness of interventions. The specific profile and description of a general or specific population may further affect incidence rates and the effectiveness of interventions. These all underscore the need for expanded data collection systems for comprehensive description and analysis of children's deaths in the state and across the country. Further study and constant maintenance is warranted to investigate long-term risk patterns for children.

The CFRT is not an answer in and of itself but rather a necessary catalyst for effecting some of the changes necessary to impact preventable children's deaths. Louis W. Sullivan, MD, former Secretary of the Department of Health and Human Service and founder of the Public Health Policy Advisory Board, identified broad societal issues, such as child poverty and increasing instability in the American family, as issues that must be considered. Community involvement is necessary, improving access to health care, increasing availability of mental health care to children, reducing the availability of firearms, decreasing racial disparities in health status, especially among young African American males who have experienced a dramatic increase in homicide and suicide deaths over the past decade. Indeed the results of this study indicate that there are racial disparities. Repeatedly, statistically significant indicators of protective effects for the entire group did not include minorities. Black males and females and to a

lesser extent, Hispanics, reflected escalating death rates. It is strongly recommended that ensuing research explore these associations.

The CFRTs across the State and country are still in the early stages of their development. The process for managing information reaped from the CFRTs and subsequent development of preventive initiatives has not yet been well orchestrated. It is imperative to take advantage of all available information regarding those factors that may impact the wellbeing of children. Towards this end, a comprehensive analysis of the data is essential towards uncovering the factors that may ultimately lead to decreasing the preventable deaths of children.

The researcher is not sure if the specific activity of the CFRT is responsible for the identified protective effect. Nor is the researcher sure if the establishment of a CFRT represents an atmosphere already conducive to protecting children. Perhaps, CFRT members indirectly communicate CFRT information that is ultimately used in the generation of interventions. Whatever the mechanism, the researcher's observations and findings from this study indicate that the CFRT is involved with helping save the lives of children.

"Mortui vivos docent – The dead teach the living." It seems this statement should immediately be followed by the adage, "those who do not learn from history are condemned to repeat it." The CFRT is the vehicle through which to mobilize what we learn from the unnecessary deaths of children. Further research is urgently indicated.

APPENDIX A
TREATMENT AND CONTROL COUNTIES 1985-1998

APPENDIX A: Treatment and Control Counties, 1985-1998

Counties in treatment group 1992:

Bexar	Parker
Dallas	Tarrant
Denton	

Counties in treatment group 1993:

Nueces	Travis
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Counties in treatment group 1994:

Bailey	Delta	Hemphill	Oldham
Borden	Dickens	Hockley	Parmer
Briscoe	Donley	Hutchinson	Potter
Carson	Fannin	Kent	Randall
Castro	Floyd	King	Red River
Childress	Gaines	Lamar	Roberts
Cochran	Garza	Lamb	Scurry
Collin	Gray	Lipscomb	Sherman
Collingsworth	Grayson	Lubbock	Stonewall
Cottle	Hale	Lynn	Swisher
Crosby	Hall	McLennan	Terry
Dallam	Hansford	Moore	Wheeler
Dawson	Harris	Motley	Yoakum
Deaf Smith	Hartley	Ochiltree	

Counties in control group:

Anderson	Fayette	Liberty	Titus
Angelina	Fort Bend	Limestone	Upshur
Atascosa	Guadalupe	Matagorda	Uvalde
Austin	Hays	Maverick	Val Verde
Bowie	Henderson	Medina	Van Zandt
Brown	Hill	Midland	Victoria
Caldwell	Hood	Montgomery	Walker
Calhoun	Hopkins	Nacogdoches	Wharton
Cass	Houston	Navarro	Wilson
Chambers	Howard	Orange	Wise
Cooke	Jasper	Palo Pinto	Wood
DeWitt	Johnson	Polk	
Eastland	Kaufman	Rockwall	
Ellis	Kerr	Shelby	
Erath	Lavaca	Taylor	

APPENDIX B:
TOTAL FREQUENCIES AND DEATH RATES 1985-1998

APPENDIX B: Total Frequencies and Death Rates 1985-1998

Treatment Group (1985-1998)						
Year	Rate /100,000	# of death	SIDS rate /100,000	SIDS# of deaths	Abuse rate /100,000	Abuse # of deaths
1985	113.4	1360	112.5	86	0.1	1
1986	114.3	1409	122.4	98	0.6	7
1987	100.4	1255	78.7	64	0.1	1
1988	101.7	1268	112.2	91	0	0
1989	107.7	1343	89.4	72	0.1	1
1990	96.5	1212	56.5	46	0.4	5
1991	91.2	1173	28.9	25	0.1	1
1992	89.2	1173	27.7	24	0	0
1993	85.3	1159	105.4	92	0.1	2
1994	79.6	1107	115	100	0.1	2
1995	75.1	1065	80.6	70	0.1	2
1996	71.8	1042	75.5	67	0.1	2
1997	69.8	1033	96.3	89	0	0
1998	66.1	999	46.5	43	0	0

Treatment Group (1987-1998)						
Year	Rate /100,000	# of death	SIDS rate /100,000	SIDS# of deaths	Abuse rate /100,000	Abuse # of deaths
1987	87.9	200	116.6	17	0	0
1988	96.4	218	153.6	22	1.8	4
1989	88.4	200	169.4	24	0.4	1
1990	74.1	169	171	25	0	0
1991	77.8	183	120.7	19	0.9	2
1992	77.8	188	119.8	19	0.8	2
1993	59.9	149	43.9	7	0	0
1994	70.4	183	80.1	13	0	0
1995	63.5	170	60.8	10	0	0
1996	63	172	48	8	0.4	1
1997	67.8	188	40.4	7	0	0
1998	59.3	167	34.2	6	1.1	3

Treatment Group (1989-1998)						
Year	Rate /100,000	# of death	SIDS rate /100,000	SIDS# of deaths	Abuse rate /100,000	Abuse# of deaths
1989	102.7	1222	159.8	115	0.1	1
1990	98.2	1183	131.2	98	0.1	1
1991	92.2	1141	117.4	95	0	0
1992	89	1130	122.5	100	0.2	3
1993	86.1	1118	123.8	101	0	0
1994	82.6	1087	147.9	119	0	0
1995	69.8	931	78.5	63	0.4	5
1996	72.6	988	80.4	66	0	0
1997	69.3	958	71.4	61	0.1	1
1998	67.3	943	64.9	55	0.5	7

Control Group (1985-1998)						
Year	Rate /100,000	# of death	SIDS rate /100,000	SIDS# of deaths	Abuse rate /100,000	Abuse # of deaths
1985	103.7	736	96.3	38	0.3	2
1986	98.2	711	95.8	38	0.3	2
1987	90.7	662	112.4	44	0	0
1988	97.5	718	156.5	49	0	0
1989	90.7	673	125.3	48	0.1	1
1990	90.3	679	112.6	52	0.4	3
1991	75.7	582	108.8	46	0.1	0
1992	85	660	113.9	48	0.1	0
1993	78.2	615	106.7	45	0.1	0
1994	71.7	577	79.9	34	0.4	3
1995	79	644	103.4	44	0.1	1
1996	78.2	653	70.5	31	0.1	1
1997	77	653	117.8	54	0.2	2
1998	70.9	607	85.3	39	0.1	1

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