Child maltreatment is a significant public health problem associated with many negative outcomes. Children who are abused and neglected fare worse than their non-maltreated counterparts. Besides immediate health and safety concerns associated with abuse and neglect, there are long-term consequences including increased emotional and behavioral challenges [1, 2], impairment to cognitive functioning [1, 3], and worse academic performance [4]. One study found that experiencing maltreatment as a child was associated with adult perpetration of child maltreatment, adult substance abuse, and adult mental health treatment [5]. Experiencing child maltreatment may increase an individual’s risk of experiencing violent relationships later in life. A history of child maltreatment has been associated with currently experiencing physical and emotional intimate partner violence [6].

Data from the National Child Abuse and Neglect Data System suggest that 7.2 million children were referred to Child Protective Services (CPS) in 2015 in the United States. Of these children, 3.4 million received either an investigation or alternative response and 683,487 unique children were found to have experienced maltreatment [7]. There were 128,944 children investigated for maltreatment by North Carolina CPS agencies in 2015 and approximately one quarter of these children were found to have experienced maltreatment [8]. The North Carolina child abuse reporting law states that everyone, not just specific professions such as physicians and teachers, has a duty to report suspected child maltreatment to CPS [9]. However, since child maltreatment typically occurs in private, child welfare reports likely underestimate the true prevalence of child maltreatment. In fact, an anonymous telephone survey conducted in North and South Carolina found a rate of child maltreatment that is 40 times higher than those derived from CPS reports [10]. This is supported by other studies as well. The most recent National Incidence Study of Child Abuse and Neglect (NIS-4), which collected data in 2005–2006, estimates that 2.9 million children were victims of child maltreatment nationally [11], which is significantly higher than the number of children who experienced maltreatment according to CPS data from the same time period [12]. This difference in numbers is due to study design. The National Incidence Study (NIS) includes both children who are known to CPS and those who are not. To do this, the NIS uses community sentinels to identify children who have experienced

Child Maltreatment Surveillance Improvement Opportunities: A Wake County, North Carolina Pilot Project

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BACKGROUND As child maltreatment often occurs in private, child welfare numbers underestimate its true prevalence. Child maltreatment surveillance systems have been used to ascertain more accurate counts of children who experience maltreatment. This manuscript describes the results from a pilot child maltreatment surveillance system in Wake County, North Carolina.

METHODS We linked 2010 and 2011 data from 3 sources (Child Protective Services, Raleigh Police Department, and Office of the Chief Medical Examiner) to obtain rates of definite and possible child maltreatment. We separately analyzed emergency department visits from 2010 and 2011 to obtain counts of definite and possible child maltreatment. We then compared the results from the surveillance systems to those obtained from Child Protective Services (CPS) data alone.

RESULTS In 2010 and 2011, rates of definite child maltreatment were 11.7 and 11.3 per 1,000 children, respectively, when using the linked data, compared to 10.0 and 9.5 per 1,000 children using CPS data alone. The rates of possible maltreatment were 25.3 and 23.8 per 1,000, respectively. In the 2010 and 2011 emergency department data, there were 68 visits and 84 visits, respectively, that met the case definition for maltreatment.

LIMITATIONS While 4 data sources were analyzed, only 3 were linked in the current surveillance system. It is likely that we would have identified more cases of maltreatment had more sources been included.

CONCLUSION While the surveillance system identified more children who met the case definition of maltreatment than CPS data alone, the rates of definite child maltreatment were not considerably higher than official reports. Rates of possible child maltreatment were much higher than both the definite case definition and child welfare records. Tracking both definite and possible case definitions and using a variety of data sources provides a more complete picture of child maltreatment in North Carolina.

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abuse and/or neglect. This information is linked to CPS data to ensure that each child is only counted once and is used to calculate national estimates of maltreated children. Additionally, NIS utilizes 2 definitions of child maltreatment: the Harm Standard and the Endangerment Standard. The Harm Standard requires that a child experience "demonstrable harm" to meet the case definition of abuse or neglect. The Endangerment Standard includes all children who meet the Harm Standard, as well as those who were identified as endangered by a community sentinel or who were found to have experienced maltreatment by CPS but did not meet the criteria of the Harm Standard. This standard also includes all adult caregivers as perpetrators and allows for adolescent caregivers to be counted as perpetrators of sexual abuse, while the Harm Standard requires that the perpetrator be a parent [11].

In an effort to ascertain more accurate numbers of children affected by maltreatment than those provided by official CPS reports, from 2001 to 2004 the Centers for Disease Control and Prevention (CDC) funded 5 states to support the development and pilot testing of child maltreatment surveillance systems [13]. While each state's system differed slightly, all 5 states used more than one data source, including emergency department records, reports to law enforcement, CPS records, hospital discharge records, and medical examiner data, to create their surveillance system [13]. All states reported that the system increased awareness of child maltreatment, the data provided by the system were disseminated, and the system encouraged the development or strengthening of collaborative relationships [13]. Additionally, states reported that the system increased available resources for prevention programs and services, improved the quality of these programs and services, and informed legislation and policies [13].

Although North Carolina was not funded by the CDC for child maltreatment surveillance, the emerging awareness of the importance of accurate numbers of children who experience maltreatment spurred the North Carolina Institute of Medicine's 2004–2005 Task Force on Child Abuse Prevention to recommend that the Injury and Violence Prevention Branch (IVPB) of the Division of Public Health (DPH) develop a child maltreatment surveillance system [14]. This recommendation was in response to concerns about the ability of North Carolina's state agencies and non-profit organizations to respond to the problem of child maltreatment in the state without having accurate prevalence numbers. According to the Task Force, this surveillance system would benefit North Carolina by providing the data required to inform policy and child maltreatment prevention efforts [14]. In response to this recommendation, the IVPB sought and received funding from the John Rex Endowment to create a child maltreatment surveillance system in Wake County, North Carolina. Wake County is centrally located in North Carolina [15]. According to the 2010 census, it is the second largest county in North Carolina, with 900,993 residents and 13 municipalities [15]. Roughly one quarter (26%) of the county is younger than 18 years of age, and 66.3% of the county is white [15]. Given the size of the county, including the number of residents, municipalities, and agencies, IVPB thought that piloting the development of a child maltreatment surveillance system in Wake County would prove useful in informing the potential development of a statewide child maltreatment surveillance system. The purpose of the current manuscript is to describe this surveillance system in Wake County, North Carolina.

**Methods**

The goal of the Wake County Child Maltreatment Surveillance System (WCMSS) was to link data sources to obtain unique counts of children who experience maltreatment in the county. It is important to note that as children can experience more than one maltreatment event a year, we were interested in quantifying unique children, not unique events. The IRBs at the University of North Carolina at Chapel Hill and at DPH determined that the project was exempt from IRB approval. To ensure the confidentiality of the individuals whose information was used for this project, the data were stored on an encrypted desktop computer that was not connected to the internet.

**Data Sources**

We received 2010 and 2011 data from CPS, the Raleigh Police Department (RPD), the Office of the Chief Medical Examiner (OCME), and the North Carolina Disease Event Tracking and Epidemiologic Collective Tool (NC DETECT). We included data from 2010 and 2011, as these were the most recent years of data available from all involved data sources at the time. Each data source is described in more detail below.

**Child Protective Services**

CPS in North Carolina is a locally-administered system with oversight from the state of North Carolina. County departments of social services provide data regarding children who are investigated for child maltreatment to the Central Registry, which is managed at the state level. Further, the child welfare system in North Carolina is a Multiple Response System that includes a traditional investigative track and a family assessment track, which is a strengths-based team approach to working with families. In the traditional investigation track, cases are either substantiated or unsubstantiated, while cases in the family assessment track are either classified as having positive findings or not. We included Wake County, North Carolina data from the Central Registry in the surveillance system, which included all accepted reports to Wake County, North Carolina CPS.

**Raleigh Police Department**

These data included all cases the Raleigh police were involved in where the victim was less than 18 years of age. It
does not include cases where one of the other law enforcement agencies in the county had jurisdiction. We chose to prioritize the RPD because they were one of the largest agencies in the county, and we expected that this would allow us to capture the largest number of cases.

**OCME**

All deaths in North Carolina that are due to, or possibly due to, a violent or traumatic injury or accident are investigated by a medical examiner and included in OCME data [16]. We included data regarding all deaths in Wake County, North Carolina among children less than 18 years of age.

**North Carolina Disease Event Tracking and Epidemiologic Collection Tool**

NC DETECT is North Carolina’s statewide syndromic surveillance system, which includes data from emergency departments, the Carolinas Poison Center, and the Pre-hospital Medical Information System. We included emergency department visits among Wake County, North Carolina residents who were less than 18 years of age. The data from NC DETECT did not include enough identifiable information to identify unique children within the dataset, only unique incidents. Therefore, those data were not included in the link-based surveillance system and were analyzed separately.

**Data Linkage**

We merged the CPS, RPD, and OCME data based on the child’s date of birth, first name, and last name. The resulting database contained the following demographic variables: city of residence, age, race/ethnicity, and sex. Additionally, the dataset included variables that indicated from which dataset the incident originated. For those children known to CPS, the dataset also contained the year of the child’s first ever report, the number of reports the child had received over his/her lifetime, and the findings of the CPS investigation(s).

**Child Maltreatment Definitions**

We chose to use 2 definitions of child maltreatment: definite and possible. These definitions were developed through consultation with key stakeholders in the county, including representatives from each agency whose data were included in the system. These consultations took place prior to our analysis, as well as after to ensure our case definitions were appropriate. Given that law enforcement and medical examiners are not agencies specific to child maltreatment, we paid particular attention to how we classified these cases. Table 1 includes a list of offenses in the RPD data we included in our case definition. The perpetrator’s relationship to the child was not known for many of the RPD cases, therefore we were not able to consider this in our case definition. We reviewed each OCME case to determine if it was child maltreatment related.

Definite maltreatment was defined as maltreatment that was substantiated or received a positive finding by CPS; coded as child abuse, assault (for children less than or equal to 8 years), or sexual assault/rape by law enforcement; and/or was ruled a homicide by the medical examiner. Possible maltreatment was applied to situations where abuse or neglect may have occurred (eg, a police report of assault on a 9-year-old child), but was unsubstantiated/had no positive findings in the CPS report. For children who were victims of assault, we chose 9 years of age as a cut off between definite and possible maltreatment because we felt that there was a high likelihood of maltreatment if a child aged 8 or younger was the victim of an assault, but we were less confident that it was not a peer-on-peer assault if the child was 9 or older. We chose to include accepted CPS reports that were unsubstantiated/did not have a positive finding in the possible definition because the literature suggests that substantiation does not necessarily accurately reflect a family’s level of need or if maltreatment occurred [17, 18, 19].

We also used definite and possible definitions for the emergency department (NC DETECT) data. Since these data contained International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) billing codes, we used the billing codes for child maltreatment and also applied a coding algorithm for possible child maltreatment [20]. This algorithm was developed by reviewing medical records that included an ICD-9-CM code for an injury and/or condition that was identified by an expert panel as raising concerns for child maltreatment. If greater than 66% of the cases with those codes were classified as child maltreatment, the ICD-9-CM code was included in the algorithm. We slightly modified this coding algorithm based on our project’s goal of examining the number of child maltreatment incidents in the NC DETECT data. The previously established algorithm includes weights based on the percentage of cases reviewed that were classified as maltreatment;

### Table 1.

**Offenses in Raleigh Police Department Data Included in Child Maltreatment Case Definition**

| Offense | Definition |
|---------|------------|
| Assault simple (not aggravated) | |
| Assault with firearm | |
| Assault with knife or other cutting instrument | |
| Child neglect | |
| Child/ offense against family—all other | |
| Driving while impaired | |
| Murder/manslaughter by negligence | |
| Rape by force | |
| Sex offense/all other sex offenses | |
| Sex offense/incest | |
| Sex offense/indecency | |
| Sex offense/indecency with a minor | |
| Sex offense/sodomy, crime against nature | |
| Sex offense/statutory rape | |
however, there were incidents in our data that received more than one code indicative of possible maltreatment and it was not clear which weights to apply in that situation. Therefore, we did not use the weights in our analysis. Examples of diagnoses in this possible case definition include near drowning of a child less than 4 years of age and rib fracture in a child less than 5 years of age. We applied these case definitions to 2010 and 2011 NC DETECT data for individuals less than 18 years old.

**Data Analysis**

Once the 3 datasets were linked, we calculated the number of children who experienced definite maltreatment and possible maltreatment. Children were counted as definitely maltreated if any maltreatment incident they experienced was coded as definite maltreatment in one or more data sources. Possible maltreatment included all children with at least one possible maltreatment code and no definite maltreatment codes. These numbers were used to calculate rates of maltreatment for children less than 18 years. We obtained the number of children less than 18 years of age in Wake County for both 2010 and 2011 from the US Census American Community Survey [21]. We also compared the rates and number of children identified by the WCMSS to those obtained from only examining CPS data. We separately analyzed the deidentified NC DETECT data to determine the number of children who met each case definition in Wake County, North Carolina.

**Results**

In 2010, 2,599 children in the linked data set met the case definition for definite child maltreatment and 5,618 met the criteria for possible maltreatment. Similarly, in 2011, 2,562 children met the case definition for definite maltreatment and 5,466 met the definition of possible maltreatment. According to only the CPS data, 2,228 and 2,177 children were either substantiated or received a positive finding for maltreatment in 2010 and 2011, respectively. Thus, the linked data identified an average of 378 additional cases of definite child maltreatment. Table 2 displays the rates and numbers of children for each year and case definition, as well as the rates and numbers of children in the CPS data.

In 2010, 37 emergency department visits received diagnosis indicative of definite child maltreatment and 31 of possible maltreatment. Similarly, in 2011, 35 emergency department visits met the case definition for definite child maltreatment and 49 met the case definition of possible maltreatment (see Table 3).

**Discussion**

This is the first study to describe an attempt at creating a child maltreatment surveillance system in North Carolina. Linking the 3 datasets resulted in identifying an average of 378 more incidents of definite child maltreatment than were in the CPS data alone. However, the rates of definite child maltreatment were not substantially higher than CPS rates during the same years. As expected, the rates of possible maltreatment were around twice as large as rates found in CPS data. Additionally, we identified visits with definite and possible maltreatment codes at emergency departments. By applying definite and possible definitions to the emergency department data, we captured more visits (68 and 84 visits, respectively) for children who potentially experienced abuse and/or neglect than with the ICD-9-CM explicit maltreatment codes alone. It’s important to note, however, that these emergency department visits represent less than 4% of the count of the definite maltreatment cases in the CPS records (4,405 cases over both years).

Given that the burden of evidence can be great for an incident to be substantiated by CPS [13, 15], it is useful to track a broader definition of child maltreatment. Estimating possible maltreatment in conjunction with the more traditional definite case definition mirrors the perspective of the NIS harm and endangerment standards [11]. It has been suggested that there is a high level of service need among families who are not substantiated for child maltreatment [17, 18, 19]. Indeed, 2 studies did not find an association between substantiation status and risk of recidivism for child maltreatment [18, 19]. Additionally, previous research has found that developmental outcomes for children whose CPS reports are substantiated are similar to those that are unsubstantiated [22]. Therefore, examining trends of both the narrow and broad definitions paints a more complete picture of childhood adversity, as children included in the possible definition experienced concerning events as well. This broader view of the number of children who experience traumatic events in childhood, given their similar outcomes, should be used to expand prevention strategies and may inform policy and funding decisions.

**Limitations**

The major limitation to the current surveillance system is that only data from 3 agencies were included. More maltreatment incidents may have been identified had we been able to include data from more agencies in the system. For example, Wake County, North Carolina is home to over 10 law enforcement agencies, and there is not a centralized system for these data in North Carolina. This means that each agency needed to be approached individually and enter into

| TABLE 2. Prevalence of Child Maltreatment |
|------------------------------------------|
| 2010 Rate per 1,000 children < 18 years old (#) | 2011 Rate per 1,000 children < 18 years old (#) |
| Definite | 11.7 (2599) | 11.3 (2562) |
| Possible | 25.3 (5618) | 23.8 (5466) |
| CPS definite | 10.0 (2228) | 9.5 (2177) |

Note. CPS, Child Protective Services.
a separate agreement to provide data to the system. Given the time constraints of the current project, it was not possible to approach each agency in Wake County, North Carolina. A centralized law enforcement data system would make accessing county-level and statewide law enforcement data much easier in North Carolina. Such a system could benefit surveillance and research of a range of topics, including child maltreatment. The data we received from NC DETECT did not include enough identifiable data to be merged with the other data sources. Identifiable data served 2 purposes in our system: providing variables to link between datasets and enabling us to identify unique children within each dataset. Future child maltreatment surveillance projects may want to consider asking partners who are reluctant or unable to provide certain identifiable data elements if they could include a variable that link multiple incidents that occurred to the same child. This would enable them to determine if a child experienced more than one incident in a year, and they could create a child-level dataset rather than an incident-level one. Once the datasets were organized at the child level rather than the incident level, it would be possible to consider other ways to link those data to the other datasets, such as probabilistic data matching. Additionally, since we were not able to include the NC DETECT data in the merged dataset, we do not know if the children represented by those visits are included in any of the other data sources, including CPS.

**Conclusion**

While the child maltreatment surveillance system was able to identify more children who met criteria for definite maltreatment than CPS records alone, the rates of definite child maltreatment did not substantially increase. Given the time and resources required to develop such a system, as well as the difficulty obtaining data, it is not clear that a link-based child maltreatment surveillance system is an efficient use of resources at this point. When centralized, a link-based child maltreatment surveillance system is an efficient improvement to statewide child maltreatment surveillance. Overall, the rates of possible maltreatment were more than twice those of definite maltreatment and likely include many cases of abuse and neglect. Additionally, these definite and possible rates may not co-vary within a county and may inform different intervention strategies. We therefore recommend tracking both the narrow definite case definition and the broader possible definition of child maltreatment to have a more complete picture of the problem of child maltreatment in North Carolina. NCMJ

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**TABLE 3.**

| Number of Emergency Department Visits Receiving Diagnoses Indicative of Definite and Possible Maltreatment | 2010 (N) | 2011 (N) |
|--------------------------------------------------------------------------------------------------------|---------|---------|
| Definite maltreatment                                                                                   | 37      | 35      |
| Possible maltreatment                                                                                    | 31      | 49      |
| Total                                                                                                    | 68      | 84      |

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