Title: How much justice is denied? An estimate of unsubmitted sexual assault kits in the United States.

Authors: Kevin Strom, Thomas Scott, Hannah Feeney, Amanda Young, Lance Couzens, Marcus Berzofsky (RTI International)

Published in *Journal of Criminal Justice*, 73, 101746.

https://doi.org/10.1016/j.jcrimjus.2020.101746

Abstract

Purpose: Prior national, state, and local investigations of law enforcement agencies have revealed large stockpiles of sexual assault kits (SAKs) that were not submitted to a laboratory for forensic testing. The failure to submit these SAKs has resulted in incomplete investigations for sexual assault victims and a lack of accountability for sexual assault offenders. To direct national policy aimed at testing these kits and reducing future stockpiles, it is essential to realize the magnitude of the problem. Methods: This study uses information on known unsubmitted SAK counts from 911 counties in 15 states and a multitude of county-level covariates to estimate the national number of unsubmitted SAKs during the period 2014-2018. Results: Based on 95% confidence intervals, there were an estimated 300,000 to 400,000 unsubmitted SAKs in the United States during this period. A county's population was the strongest predictor of whether the county had an unsubmitted SAK count, while county sociodemographic factors and state legislative actions were the strongest predictors of the size of county unsubmitted SAK counts. Conclusions: To improve future estimates, LEAs should account for SAKs throughout the investigative and laboratory submission stages and states should conduct annual high-quality audits that leverage tracking processes.

Keywords: unsubmitted sexual assault kit; rape kit backlog; sexual assault forensic evidence

Highlights

- Vast amounts of sexual assault kits are never submitted for forensic testing by law enforcement agencies
- Imputation and estimation model found between 300,000-400,000 unsubmitted sexual assault kits between 2014-18
- County sociodemographic characteristics, crime levels, and state legislation predict county unsubmitted sexual assault kit counts
- Lack of state data is a major issue for informed decisions to reduce the rape kit backlog

Introduction

Sexual assault is widespread in the United States. As many as 1 in 5 (19.3%) women and 1 in 71 (1.7%) men report being raped in their lifetimes (Breiding, et al., 2014). After an assault, some survivors choose to seek care from medical providers, where injuries can be treated and a sexual assault kit (SAK) can be collected to preserve physical evidence for potential use within the criminal justice system (Campbell, Patterson, & Lichty, 2005). SAK collection typically comprises a history of the assault, a head-to-toe physical exam, and specimen collection from body surfaces (e.g., swabbing of the vulva, anus, or mouth) (Campbell, et al., 2005). This process is often long and invasive for victims, but it is completed with the intention that the SAK will be submitted by the responding law enforcement agency (LEA) to a forensic laboratory for testing and used to aid in the criminal investigation and prosecution of the offender (Campbell, et al., 2015).

The benefits of SAK testing are far-reaching. Testing the forensic evidence within a SAK allows for potential extraction of DNA profiles that may then be uploaded into Combined DNA Index System (CODIS). Uploads may then support the identification of previously unknown offenders, confirmation of the identity of known offenders, and/or establishment of linkages to serial sex offenders. Additionally, SAK testing may result in additional sanctions for suspected sexual offenders (e.g., increased likelihood of arrest and conviction; Lovell, Luminais, Flannery, Bell, & Kyker, 2018; Peterson & Sommers, 2010; Wells, Fansher, & Campbell, 2019). Thus, testing the DNA within a SAK can allow law enforcement to identify and prosecute offenders, preventing the opportunity for these perpetrators to commit additional sex crimes (Campbell, Feeney, Goodman-Williams, Sharma, & Pierce, 2019). For victims, choosing to have a SAK submitted for testing and having the decision executed may contribute to feelings of personal

agency, trust, and empowerment, which may ultimately support victims' healing trajectories (Ullman & Townsend, 2008; Sulley, Wood, & Cook Heffron, 2018).

Despite the tremendous utility tested SAKs provide and the hardship victims endure to provide them (Du Mont, White, & McGregor, 2009), reports from jurisdictions across the country reveal that SAKs too frequently go unsubmitted for testing by LEAs (Campbell, et al., 2017; Strom & Hickman, 2010). SAKs that law enforcement agencies do not submit for testing are referred to as *unsubmitted SAKs,* while SAKs that are submitted to crime labs for testing but remain unanalyzed are referred to as *untested SAKs.* The latter is typically caused by a lack of lab resources, changes in technology, and/or processing delays. For most communities, the former, unsubmitted SAKs, have more complicated origins including rapid changes in DNA technology, resource depletion, and/or endorsement of rape myths by law enforcement (Campbell et al., 2015; HRW, 2009). The focus of the current paper is on unsubmitted, not untested, SAKs. We occasionally refer to an agency's number of unsubmitted SAKs as their rape kit backlog.

While research has yet to establish a current number of unsubmitted SAKs at a national level, the estimate that is most frequently cited by politicians, press, and researchers is one that comes with little justification: 400,000 SAKs (Dickson, 2014; TEST400k, 2016; The White House, 2015). We tracked this estimate's origin back to at least 2004 during the passing of the Justice for All Act (U.S. Senate, 2004), but we were unable to establish a known scientific backing for its development. Instead, the 400,000 number appears to capture a rough estimate of the ever-changing number of previously unsubmitted SAKs and, importantly, reflects an estimate that was projected almost a decade before increased awareness of unsubmitted SAKs encouraged jurisdictions across the country to take stock of and reduce their stockpiles. There is a need for a national estimate that is more recent and based on transparent scientific methods to inform

current policy decisions and public discourse. Timely and research-informed information on the prevalence of unsubmitted SAKs can also serve as a key mechanism for accountability and to evaluate how successful the various reform efforts have been towards not only testing SAKs but also actively and consistently pursuing justice for victims in these cases.

Research suggests that SAK backlogs were created over decades because of multiple interwoven processes. First, rapid changes in DNA technology and misguided perceptions of SAK utility resulted in many LEAs viewing forensic testing as a futile activity for sexual assault investigations (Lovrich, et al., 2004; Strom & Hickman, 2010). For many jurisdictions, lack of critical resources (e.g., time, personnel, expendable finances) left LEAs prioritizing the investigation of cases that did not require forensic testing (Campbell, et al., 2015; Human Rights Watch, 2009). Finally, rape myth acceptance among stakeholders and decision makers resulted in choices to not invest in the safety of their most vulnerable citizens via SAK testing, particularly to the detriment of marginalized groups (Shaw & Campbell, 2013). Moreover, only recently have state legislators begun enacting laws that establish how local and state LEAs must handle SAK testing. These laws often require one or more inventories of unsubmitted SAKs, the testing of all old and/or new kits, and a process for tracking kits from collection through forensic testing (endthebacklog.org, n.d.). Without state laws like these catalyzing changes to LEA policy on SAK testing, it is possible jurisdictions would allow for SAK backlogs and their consequences to remain indefinitely.

For some jurisdictions, a “perfect storm” (Campbell, et al., 2015) of these circumstances resulted in incredibly low rates of SAK submission. For example, in the late 1990’s, researchers found that up to 50% of SAKs collected at a women’s health center went unsubmitted (Parnis, 1997). More recent research found jurisdictional rates ranged from 20% to 60% of SAKs

submitted for testing (Human Rights Watch, 2009, 2010; Patterson & Campbell, 2012). In New York, the first city to report a backlog of unsubmitted SAKs in the late 1990s, approximately 16,000 SAKs were sitting in police storage (Bashford, 2013). Over a decade later in 2009, Human Rights Watch reported that there were 12,669 unsubmitted SAKs in Los Angeles County (Human Rights Watch, 2009). More recent reports have documented between 200 (Nashville) and 12,000 (Memphis) unsubmitted SAKs in numerous cities across the United States (Campbell, et al., 2017; Joyful Heart Foundation, 2019). This problem extends far beyond cities, with individual states conducting audits to reveal similarly large numbers from 2014 through 2018 (e.g., North Carolina: 15,610 in 2018; Oregon: 4,902 in 2015; Texas: 2,138 in 2017) (Joyful Heart Foundation, 2019).

Individual agencies, cities, and states have conducted inventories to measure the scale of "justice denied" in their areas. Attempts to scale up measurement to a national level have faced many challenges, due in part to a lack of adequate tracking mechanisms and inventorying among LEAs. In one attempt at producing a national number of unsubmitted SAKs, Lovrich and colleagues (2004) surveyed a nationally representative stratified random sample of approximately 3,400 LEAs and estimated that in 1982–2002 there may have been as many as 169,000 unsolved sexual assault cases with untested biological evidence in the United States. In a follow-on study, Strom and Hickman (2010) found that 18% of unsolved sexual assault cases from 2003 to 2007 (an additional estimated 27,595 cases) contained forensic evidence that was not submitted to a crime laboratory for analysis. While these studies were critical in demonstrating the extent of the national problem, survey respondents sometimes had to approximate the presence of untested forensic evidence in unsolved cases, as they did not have the data systems or capacity to physically count evidence.

The Joyful Heart Foundation, a national advocacy group pushing for the inventorying and testing of previously unsubmitted SAKs through their End the Backlog campaign, has identified over 100,000 previously untested kits across selected states (Joyful Heart Foundation, 2019). This figure is surely an underestimate, because it does not account for unsubmitted SAKs from the 12 states that have not formally inventoried or reported their counts. Furthermore, because the number of unsubmitted SAKs is constantly changing and states use varying definitions for what constitutes an untested and an unsubmitted SAK, any national estimate must be based on clear, replicable criteria. When reviewing past audits from some of the states included in the Joyful Heart Foundation's count, we noticed state variation in both the definitions used for an unsubmitted SAK and the audit response rate. Because there is no methodology report associated with their count, it is impossible to know how the Joyful Heart Foundation handled these issues when publishing their state counts. The current study builds on their important work by estimating a national number for all 50 states and the District of Columbia that is based on unsubmitted SAK counts taken in states with consistent and correct definitions of an unsubmitted SAK and high response rates to the state audit.

The problem of shelving kits indefinitely has been referred to as "justice denied" by Strom and Hickman (Strom & Hickman, 2010, p382) because it eliminates the opportunity for the SAK to be used in criminal investigations and court proceedings. This leaves victims without a thorough exploration of their cases or the option for prosecution and offenders with the opportunity to re-offend. In addition, leaving SAKs unsubmitted for testing prevents law enforcement from making connections that can help identify repeat and serial sex offenders and exonerate wrongfully arrested or convicted individuals (Campbell et al., 2019).For these reasons, the testing of SAKs has become a national political issue (The White House, 2015) and much

federal funding has been directed to testing SAKs through the Sexual Assault Kit Initiative (SAKI; SAKI, 2019). To inform future national legislation and funding decisions in this area, it is imperative that policy makers have an accurate, evidence-based understanding of the problem's scope. Unfortunately, due to a lack of national data on unsubmitted SAKs, policy makers have relied on an estimate that is not based on any clear science. To remedy this, we use county-level inventories collected from 2014 through 2018 from 911 counties in 15 states along with multiple county-level covariates to impute the remaining counties' unsubmitted SAK counts and develop a national estimate. Although our national estimate relies heavily on imputed county counts, it is constructed from known information on many predictors of unsubmitted SAK counts and is based on transparent, consistent, and replicable procedures. Our findings describe the national extent of unsubmitted SAKs and the factors that contribute to the stockpile. This information can enable a grounded, research-driven discussion on the problem of unsubmitted SAKs, including its dynamic scope and possible causes and solutions. We also hope this study can highlight the need for a reliable and accepted process for routinely monitoring and tracking the collection, submission, and testing of SAKs at the national, state, and local level moving forward.

Methods

Sample

To generate a nationally representative estimate, we first compiled county-level unsubmitted SAK counts from 15 states, which were produced from official audits of LEAs that were conducted in each state. We provide the source of the county counts for each of these states in Appendix A. Because there was variation in the year in which states audited agency counts of unsubmitted SAKs, and because the counts are constantly changing, we were interested in

estimating the extent of the rape kit backlog over a 5-year period rather than for an individual year. For this reason, we included counts that were collected from 2014 through 2018 to produce an estimate of the national number of unsubmitted SAKs in the mid-to-late 2010s.

We collected county counts of unsubmitted SAKs from states that had close to a 100% response rate to their audit in either agency, population, or crime coverage and for which agency- or county-level counts were available. A state would have a 100% agency response rate if every LEA in the state replied to the state's audit request with their unsubmitted SAK count. Even if some LEAs did not respond to the audit, a state could still have a population and crime coverage rate near 100% if the LEAs that did not respond had jurisdiction over a small population with few sexual assaults. For example, Florida had an agency response rate of 75%, but the agencies that did respond covered 89% of both Florida's population and its sexual assault offenses reported to law enforcement (Florida Department of Law Enforcement, n.d.). Overall, because some agencies were missing from county counts, we acknowledge that our national estimate may be biased downward. We discuss how we use these county counts and additional county-level data to produce a nationally representative estimate in the Analytic Plan section below. Table 1 shows the number of counties that provided a count of their unsubmitted SAKs and the year in which the count was collected for each of our 15 states.

[INSERT TABLE 1 ABOUT HERE]

Measures

We compiled multiple county-level covariates to use in our imputation model. These covariates fall into five groups: population variables, university population variables, crime variables, law enforcement officer variables, and state legislation variables, which are detailed below. Because so little is known about the causes of the rape kit backlog, especially at the

county level, we study a multitude of potential predictors to uncover possible causal relationships for future research and leverage these relationships to produce national estimates. Due to the large number of covariates and the uncertainty regarding the direction or strength of their relationships to a county's number of unsubmitted SAKs, we did not test hypotheses for each individual effect. The primary purpose of this study is to use these relationships to generate a national estimate and not to test causal relationships at the county level. We discuss broad motivations for including variables from each group in their respective section.

Population variables. We selected county population variables from the 2016 Social Vulnerability Index (SVI) datafile compiled by the Centers for Disease Control and Prevention (2016). The SVI datafile provides county-level population estimates of multiple measures of socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Almost every variable in the SVI is a 5-year average estimate from the American Community Survey, 2012–2016. The SVI datafile provided a convenient way to access multiple county population measures over the same period that our outcome was measured. Prior research suggests that urban areas, minority groups, and disenfranchised communities are differentially affected by the problem of unsubmitted SAKs (Campbell, et al., 2017; Shaw & Campbell, 2013). We therefore included the following estimates in our analyses: the total population; the population per square miles; the daytime population per total population; the population per housing units; the per capita income per population; and the percentages of persons aged 17 and younger, persons aged 65 and older, occupied housing units with more people than rooms, housing in structures with 10 or more units, uninsured in the total civilian noninstitutionalized population, the civilian noninstitutionalized population with a disability, persons in institutionalized group quarters, the percentage of persons aged 5 and older who speak

English less than well, the percentage minority, mobile homes, the percentage of persons aged 25 and older with no high school diploma, the percentage of households with no vehicle available, the percentage of persons below poverty, the percentage of single parent households with children under 18, and civilians aged 16 and older who are unemployed. Many of these measures capture how urban the county is, such as the county population, density, and percent of the population living in multiple unit buildings, which should relate both to the number of SAKs provided to law enforcement and agency resources for submitting these SAKs. Other variables measure community disadvantage, including the percentage of the population that are uninsured and the percentage of households that are single parent households.

University population variables. While prior studies have not associated unsubmitted SAKs with university LEAs, research has systematically identified college-aged individuals to be at great risk for sexual victimization (Fisher, Cullen, & Turner, 2000; Krebs, et al., 2009; Sinozich & Langton, 2014). As such, using the Integrated Postsecondary Education Data System from the National Center for Education Statistics (National Center for Education Statistics's (NCES), n.d.), we obtained county-level population rates of male, female, and total 12-month postsecondary institution student enrollments for the school year 2016–2017. Counties with a college or university have a disproportionate number of young people during much of the year, which should increase the number of SAKs received by law enforcement relative to similar counties without a college or university.

Crime variables. For each county, we calculated 5-year average population-based rates of sexual assault offenses, violent index offenses, and property index offenses reported to law enforcement for the years 2012–2016, using Jacob Kaplan's yearly offenses known and clearances by arrest 1960–2017 datafile (Kaplan, 2019b). Because of missing agency- and

county-level data, we did not include measures of arrests, and we did not include separate rates of completed and attempted rapes. After controlling for population and law enforcement officer variables, counties with more crime could have LEAs with more limited resources, which might contribute to more unsubmitted SAKs. Alternatively, counties that experience fewer sexual assaults per year could lack the appropriate policies and procedures for promptly testing SAKs.

Law enforcement officer variables. Using Jacob Kaplan's yearly concatenated law enforcement officers killed and assaulted 1960–2017 datafile (Kaplan, 2019a), we created 5-year averages of the rate of female officers per total officers and the rate of total officers per population for each county for the years 2012–2016. Counties with more officers per population should have greater resources to fully investigate sexual assaults and submit SAKs for forensic testing compared to counties with fewer officers per population. Agencies that hire more female officers might take sexual assault investigations more seriously and be more likely to devote more resources to thoroughly investigating these crimes (Schuck, 2017).

State legislation variables. The Joyful Heart Foundation provided us with a datafile containing the years states passed SAK-related legislation (collected as part of its End the Backlog initiative) (endthebacklog.org, n.d.). The specific variables include the year that one or more laws were passed requiring an inventory of each state's unsubmitted SAKs; whether those laws called for a one-time or annual inventory; the year that a law was passed requiring the testing of old, new, or old and new kits; the year that a victims' rights to notice law was passed; the year that a state law was passed requiring the tracking of kits; and the year that state funding was provided. For each variable, we created binary indicators measuring whether a law was passed before 2018. Counties residing in states with these laws have faced greater pressure to

reduce their backlog and therefore should have fewer unsubmitted SAKs compared to similar counties residing in states without these laws in place.

Analytic Plan

To estimate the national number of unsubmitted SAKs for the period 2014–2018, we imputed missing county-level unsubmitted SAK counts using the known county counts from our sample of states and our covariate measures. The representativeness of our estimate to the nation depends on how generalizable the county-level relationships between our model covariates and unsubmitted SAK counts are to counties in states that were not included in the analysis. Although there is no way of knowing this because of the missing data, we gauge the sensitivity of our estimate by building multiple imputation and estimation models with different mechanisms for including covariates and comparing the results. Although this estimate will be rough and will have a wide confidence interval, it will be the only national estimate that is based on a transparent and scientific method that has a logical backing. Our imputation model is based on a missing at random (MAR) assumption (i.e., that missing county unsubmitted SAK counts are dependent on the model covariates and not the number of unsubmitted SAKs). In light of the large and comprehensive set of predictors we had to use in our model, we determined this assumption to be appropriate. If this MAR assumption is correct, unsubmitted SAK counts from a high level of missing counties can be imputed with accuracy but the level of uncertainty (i.e., the width of the resulting confidence interval) will be larger as the rate of missing increases.

Among the 911 counties with known counts, 139 (15%) had no unsubmitted SAKs. This high volume of zeros is an indication that there may be two processes at work: one driving states to have a backlog of unsubmitted SAKs (i.e., yes or no) and another driving the volume of unsubmitted SAKs (i.e., if unsubmitted SAKs existed, the number of SAKs). To account for this,

our imputation and estimation approach modeled these processes separately. First, a logistic regression model was fit among counties with known SAK counts, with a binary outcome indicating whether a backlog existed. Counties with missing SAK counts were assigned backlog-existence propensity scores based on this model. Next, a Poisson regression model (offset by county population size) was fit among counties with known SAK counts greater than zero. This model was used to estimate, for counties with unknown counts, the size of the county's unsubmitted SAK backlog, assuming the county has one. In this two-model approach, the product of the estimated backlog-existence propensity and backlog size served as the county-level estimate of unsubmitted SAKs. These estimates were combined with observations from counties with known counts and aggregated across all counties to derive a national estimate and confidence interval for unsubmitted SAKs. We computed the variance for the combined estimates from both models using the delta method (Taylor series linearization), assuming independence between the two models and a correlation of one between the two model estimates (Agresti, 2002, p579). This core approach was permuted in three ways, each using a different set of predictors, to bound our national estimate.

In our first, "naïve" model, we assumed that the only county-level covariate that predicts a county's count of unsubmitted SAKs is its population and the square of its population. In our second model, we conducted a stepwise regression in which an automated stepwise algorithm selects covariates based on the statistical significance of the covariate and the other covariates in the model and removes covariates that are no longer statistically significant. This data-driven model selection procedure is useful in exploratory analyses such as this, especially given the variety of variables that could be associated with SAK submission. Finally, we reviewed the variables selected by the data-driven model and used our extensive subject matter expertise of

correlates of unsubmitted SAKs to select a subset of predictors for a third model. Ultimately, 18 covariates were selected for our third model to represent the concepts of urbanicity and population density, community and agency resource depletion, presence of university students, presence of marginalized groups, and legislation enacted related to the reduction of unsubmitted SAKs. This third model represents a more parsimonious model than our 32-covariate second model. All model results were compared and are presented in the Results section.

Results

[INSERT TABLE 2 ABOUT HERE]

National Estimates

Table 2 shows a bounded estimate for the national number of unsubmitted SAKs during the mid-to-late 2010s of between 247,000 at the low end of Model 1 and 412,000 at the high end of Model 3. We believe Models 2 and 3 are more accurate than the naïve model because they incorporate a greater number of covariates. These models produce national estimates in the approximate range of 300,000 to 400,000 unsubmitted SAKs. As mentioned previously, we believe these estimates are slightly lower than the true number of unsubmitted SAKs during this period because, for some states, we were forced to exclude unsubmitted SAK counts from nonresponding agencies and state police departments from our imputation and estimation models.

Covariates of Previously Unsubmitted Sexual Assault Kits

Because our analytic strategy involved imputing a county-level national estimate when most of the data are missing (i.e., county-level data from the 35 states where counts of unsubmitted SAKs were not known), we do not present beta coefficients from our regression models. Rather, we discuss covariates in terms of effect directions and relative magnitudes. If a

covariate's value in the direction of effect column is a '+', then an increase in the covariate increases the county's log odds of unsubmitted SAKs—either of having any SAK backlog in the logistic regression or the number of unsubmitted SAKs in the Poisson regression—net the other covariates in the model. A value of '-' means that an increase in the covariate decreases the county's log odds of unsubmitted SAKs, holding the other covariates in the model constant. Table 3 lists covariates by their Wald chi-square value to show each in order of its ability to predict county unsubmitted SAKs. Each covariate with a value for its Wald chi-square statistic is statistically significant with a P-value < 0.05, suggesting a county-level association between the covariate and the unsubmitted SAK count.

Results indicated that a county's population consistently predicts whether the county had a SAK backlog during this period, and, if a county did have a backlog, that measures of population density, other sociodemographic characteristics, levels of crime, and the presence of state legislation to address the backlog were associated with a county's number of unsubmitted SAKs. Notably, effect sizes and directions are informative but should be interpreted with caution given the limitations of the data. As such, we focus most of our attention on the national unsubmitted SAK count estimate produced by each model (see Table 2).

[INSERT TABLE 3 ABOUT HERE]

Discussion

This study provides critical, policy-relevant findings on the national prevalence of unsubmitted SAKs. Using a theoretically derived and innovative set of imputation and estimation models, analyses revealed an estimated 300,000 to 400,000 SAKs that were not submitted by LEAs for forensic testing but were sitting in storage facilities across the nation during the 2014-2018 period. The point estimates from these models (339,000 for Model 2; 347,000 for Model 3)

were between 60,000 and 50,000 less than 400,000, the most widely reported estimate of unsubmitted SAKs in the 2014-15 timeframe (Dickson, 2014; TEST400k, 2016; The White House, 2015), but one in which there is no known scientific basis. During this same period, there was a sharp rise in attention directed to the unsubmitted SAK stockpile and the underlying contributors to the problem by the public and media. Many states also saw new legislation in the form of submission, testing, and SAK tracking requirements. Critically, there was also a strong push in federal funding and technical support provided to state and local jurisdictions to address unsubmitted SAKs. As an example, through the Bureau of Justice Assistance's SAKI, over 110,000 previously unsubmitted SAKs were inventoried with nearly 60,000 tested between 2016 and the end of 2019 (SAKI, 2019). SAKI has also sought to increase capacity and processes within the sexual assault response to reduce the likelihood that new backlogs emerge. Because of these events, there was a need for a recent national estimate of the unsubmitted SAK backlog based on transparent and scientific methods.

One must take notice of hundreds of thousands of unsubmitted SAKs. These figures represent up to 400,000 victims who underwent the hardship of providing a kit to law enforcement for no outcome, and up to 400,000 offenders who were not held accountable for committing serious violent crimes, and, in some instances, were permitted to go on to victimize others. The impact of our figures on victims, offenders, the criminal justice system, and society cannot be understated. First, our results demonstrate an enormous lack of justice for sexual assault victims. Some victims experience secondary victimization because of this failure as it exemplifies the ways in which the criminal justice system has not cared for them (Feeney, Campbell, & Cain, 2018; Campbell et al., 2017). However, research has shown that testing previously unsubmitted SAKs and the subsequent victim notification can help mitigate negative

impacts. When done well, victim notification may support victim healing and empowerment (Ahrens, Dahlgren, & Howard, 2020; Ahrens, Swavola, & Dahlgren, 2016; Campbell et al., 2017; Lovell et al., 2017). For some survivors, this healing may be supported by prosecution of an offender.

Research shows that testing SAKs can result in additional sanctions for sexual offenders including an increased likelihood of arrest and conviction (Lovell, et al., 2018; Peterson & Sommers, 2010; Wells, et al., 2019). For example, Peterson, Hickman, Strom, and Johnson (2013) examined the effect of laboratory testing of forensic evidence on case outcomes for 4,205 criminal cases in five U.S. jurisdictions. They found that testing was positively associated with the likelihood of arrest, referral for charges, charges filed, trial conviction, and sentence length. Additionally, had the 300,000-400,000 unsubmitted SAKs been tested, research suggests that many of these sanctions would have applied to serial sex offenders (Campbell, Feeney, Pierce, Sharma, & Fehler-Cabral, 2018; Lovell, Huang, Overman, Flannery, & Klingenstein, 2019; Lovell et al., 2018). For instance, in an examination of the testing of unsubmitted SAKs in Cuyahoga County, Ohio, Lovell and colleagues (2018) reported that 27% of offenders in investigations from previously unsubmitted SAKs that were tested had victimized more than one person.

SAK testing may also benefit those who have been wrongfully accused or convicted of a crime, as DNA testing is the most common way to exonerate those wrongfully prosecuted for a sexual assault (Gross & Schaffer, 2012). Finally, cost-benefit analyses of testing unsubmitted SAKs (Wang & Wein, 2018) and DNA testing in sexual assault cases (Davis & Wells, 2019) and other high-volume crimes (Roman, Reid, Reid, Chalfin, Adams, & Knight, 2008) suggest that U.S. society sees a larger return on its investment in policing when SAKs are tested consistently.

Thus, had the 300,000-400,000 previously unsubmitted SAKs estimated in this study been tested at the time of their collection, it is likely that public resources would have been used more efficiently and effectively. In its entirety, this research shows how important it is to multiple stakeholders to test these unsubmitted SAKs immediately and to prevent future untested SAK stockpiles from forming.

Our results for the significant predictors of county unsubmitted SAK counts, found in table 3, shed light on what state and local governments and law enforcement agencies can do to reduce the magnitude of future rape kit backlogs. Unsurprisingly, we found that a county's population consistently predicts whether the county has unsubmitted SAKs: the smaller the county, the less likely it is to have unsubmitted SAKs. County population was less influential in our Poisson regressions to predict the *number* of unsubmitted SAKs. Instead, the most important predictors across models were county sociodemographic factors like population density and crime rate, as well as the enactment of state legislation to address SAK stockpiles before 2018. Variables suggesting greater rates of poverty in a county (e.g., percentage of occupied housing units with more people than rooms) were also associated with a greater number of unsubmitted SAKs, a finding consistent with prior research on community resource depletion and SAK backlogs (Campbell, et al., 2015). This is a critically important finding that warrants attention and additional research and lends further support to the notion that there are major breakdowns in how victims in economically and socially disadvantaged areas are being supported by the justice system in their sexual assault cases. Local governments and law enforcement agencies must invest the resources necessary to ensure that justice is not denied for victims of sexual assault from disadvantaged groups and communities. Our results suggest that doing so can reduce the number of unsubmitted SAKs.

Interestingly, there was a negative relationship between the number of reported rapes and the number of unsubmitted SAKs in a county. We suspect that this finding may be related to inconsistent investigatory practices regarding sexual assault in jurisdictions with fewer officially reported rape cases (e.g., those encountering more SAKs may develop more formal and effective procedures for the processing of kits). The direction of relationships was sometimes counterintuitive, although we caution against overinterpretation because of the incomplete specification of our models. Even so, knowing which factors have the strongest relationship to a county's number of unsubmitted SAKs and the direction of those relationships can help build theory and research to better explain the causes of SAK backlogs. More research is needed toward this endeavor.

As acknowledged previously, there were important limitations to our data and statistical analyses that qualify our findings. There are 3,142 counties or county equivalents in the 50 U.S. states and the District of Columbia. We used data available from 911 counties and imputed the number of unsubmitted SAKs for the remaining 2,231. Imputation was necessary because of the lack of county-level unsubmitted SAK counts in most states (endthebacklog.org, n.d.). Even for states that conducted a statewide count of their unsubmitted SAKs, limitations to the audit were considered, including unclear definitions of terms, a low response rate, a limited scope, a lack of information, and the unavailability of the results at the agency or county level. Because of the limitations of our approach, we have directed attention to each estimate's confidence interval to acknowledge the uncertainty in estimates of the national unsubmitted SAK count in the face of much missing data. Politicians, the press, and researchers have cited 400,000 as the size of the backlog for well over a decade and the current study made a concerted effort to explore its validity. Thus, despite the methodological challenges presented, we believe our national estimate

is currently the most accurate, as it is based on statistical methods and numerous county-level covariates that predict a county's number of unsubmitted SAKs. It also benefits from transparent data collection and estimation procedures, which prior estimates of the rape kit backlog have lacked.

Additionally, it is important to acknowledge that the number of unsubmitted SAKs in the United States is not a static figure. Since its start in 2015, SAKI funds have led to a reduction in unsubmitted SAKs across the U.S. and simultaneously, an increase in public attention has resulted in political pressure and state legislation focused on decreasing backlogs. While SAK submissions have increased, forensic labs have struggled to keep up, often shifting delays in testing from LEAs to forensic laboratories. Thus, while some LEAs are actively processing previously unsubmitted SAKs, others are not able to keep up and new backlogs may be forming. Because of the fluid, shifting nature of this problem, our estimates capture an approximate count for a 5-year period (2014–2018). This methodology could be replicated to determine how the national estimate for unsubmitted SAKs may have changed as the result of the resources and support that have gone into addressing the problem.

Our estimate points to a need to create more consistency, accountability, and understanding within law enforcement for the importance of fully investigating sexual assaults in their jurisdictions. Although many investigators, laboratory technicians, and advocates work tirelessly to remedy this situation, for too many sexual assault victims, justice will remain denied. Our county-level covariates shed some light on the predictors of unsubmitted SAK counts, but more research is needed to understand the underlying systemic problems that have allowed for these injustices to have occurred for such a long period. We encourage local, county, and state law enforcement agencies to work with advocates and researchers to understand how

their untested SAK backlogs formed, how to best test unsubmitted SAKs and notify victims, and how to improve their response to and investigation of reported sexual assaults.

The high number of unsubmitted SAKs revealed through our analyses suggests that jurisdictions across the nation must firmly commit to reducing the SAK backlog in the United States. Prior research has found that testing SAKs increases the likelihood of solving open sexual assaults, even if the sexual assault with which the SAK is associated is already solved (Campbell, et al., 2017). A greater number of violent sexual offenders, particularly serial offenders, could be brought to the attention of police and thus potentially limit their opportunities to re-offend (Campbell, et al., 2019). This type of "prevention" also has implications for cost savings, so while testing all SAKs may be challenging in resource-constrained communities, there are likely long-term financial benefits to this approach (Wang & Wein, 2018). Importantly, testing SAKs in a timely manner demonstrates respect for victims and their right to diligent investigations of their cases. Our results suggest additional attention must be paid to ensuring equal justice for victims of sexual assault from disadvantaged groups and communities.

Our concluding statement is a call for the nation to develop a research-supported process for monitoring how the criminal justice system is performing with respect to not only submitting and testing new and existing SAKs, but also investigating and prosecuting the cases associated with this evidence. If all states integrated adequate state-level SAK tracking systems, more accurate and updated counts could be provided to stakeholders working to process the current backlog, along with policy makers and the public. Additionally, victims could receive real time notifications of the progression of their cases, making victim notifications of case updates years after the offense and forensic exam a thing of the past. This will require funding for new technology and the effective communication of this technology to LEAs, prosecutors, and

forensic laboratories. Of course, this is only one piece of a larger puzzle in improving criminal justice systems' responses to sexual victimization. Additional research and efforts are needed to support advancements in forensic laboratories, the prosecution of sexual assaults, and victim services. Importantly, understanding the correlates and suspected causes of the SAK backlog can equip policy makers with the information needed to improve responses to survivors on a large scale and prevent possible occurrences of future victimization.

Acknowledgements: We are thankful to the Joyful Heart Foundation and multiple others for providing data for this project, including Danielle Lindgren (CT), Marcella Scott (FL), Bradley Campbell (KY), Matt Opsommer (MI), Donna Richmond (NM), Kelly Carpenter (VA), and Katharine Hemann (WA).

REFERENCES

Agency for Toxic Substances and Disease Registry. (2016). Social vulnerability index (SVI). In (Vol. 2019). Atlanta, GA: Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry, Geospatial Research, Analysis, and Services Program.

Agresti, A. (2002). *Categorical data analysis* (2nd ed.). Hoboken, NJ: John Wiley and Sons Inc.

Alaska Department of Public Safety. (n.d.). Sexual assault kit initiative: Statewide inventory of untested sexual assault kits. In (Vol. 2019). Anchorage, AK: Alaska Department of Public Safety.

Ahrens, C. E., Dahlgren, S., & Howard, R. (2020). Rape kit notification: Recommendations and barriers to reconnecting with survivors. *Journal of Trauma & Dissociation, 21*(4), 419-436.

Ahrens, C. E., Swavola, L., & Dahlgren, S. (2016). *Comprehensive technical report of the Joyful Heart Foundation victim notification project*. New York, NY: Joyful Heart Foundation.

azgovernor.gov. (2016). Arizona sexual assault evidence collection kit task force. In (September 30 ed., Vol. 2019). Phoenix, AZ: State of Arizona.

Bashford, M. (2013). New York City's Sexual Assault Kit Backlog Project: Lessons learned. In (March ed.). Washington, DC: Webinar presented for the National Center for Victims of Crime.

Breiding, M. J., Smith, S. G., Basile, K. C., Walters, M. L., Chen, J., & Merrick, M. T. (2014). Prevalence and characteristics of sexual violence, stalking, and intimate partner violence victimization—National Intimate Partner and Sexual Violence Survey, United States, 2011. *MMWR: Surveillance Summaries, 63*, 1-18.

Campbell, R., Feeney, H., Fehler-Cabral, G., Shaw, J., & Horsford, S. (2017). The national problem of untested sexual assault kits (SAKs): Scope, causes, and future directions for research, policy, and practice. *Trauma, Violence & Abuse, 18*, 363-376.

Campbell, R., Feeney, H., Goodman-Williams, R., Sharma, D. B., & Pierce, S. J. (2019). Connecting the Dots: Identifying Suspected Serial Sexual Offenders Through Forensic DNA Evidence. Psychology of Violence. Advance online publication. http://dx.doi.org/10.1037/vio0000243

Campbell, R., Feeney, H., Pierce, S.J., Sharma, D.B., & Fehler-Cabral, G. (2018). Tested at last: How DNA evidence in untested rape kits can identify offenders and serial sexual assaults. *Journal of Interpersonal Violence, 33*(24), 3792-3814.

Campbell, R., Fehler-Cabral, G., Pierce, S. J., Sharma, D. B., Bybee, D., Shaw, J., Horsford, S., & Feeney, H. (2015). *The Detroit Sexual Assault Kit Action Research Project final report.* Washington, DC.

Campbell, R., Patterson, D., & Lichty, L. F. (2005). The effectiveness of sexual assault nurse examiner (SANE) programs: A review of psychological, medical, legal, and community outcomes. *Trauma, Violence & Abuse, 6*, 313-329.

Campbell, R., Pierce, S. J., Ma, W., Feeney, H., Goodman-Williams, R., & Sharma, D. B. (2019). Will history repeat itself? Growth mixture modeling of suspected serial sexual offending using forensic DNA evidence. *Journal of Criminal Justice, 61*, 1-12.

Davis, R.C., & Wells, W. (2019). DNA testing in sexual assault cases: When do the benefits outweigh the costs? *Forensic Science International, 299*, 44-48.

Dickson, C. (2014, April 14, 2017). Justice delayed: How the U.S. ended up with 400,000 untested rape kits. *Daily Beast*.

Du Mont, J., White, D., & McGregor, M. J. (2009). Investigating the medical forensic examination from the perspectives of sexually assaulted women. *Social Science and Medicine, 68*, 774-780.

Edelen, A. H. (2015). # Victims Matter: A special report on untested sexual assault kits in the Commonwealth of Kentucky. In. Frankfort, Kentucky: Auditor of Public Accounts, Commonwealth of Kentucky.

endthebacklog.org. (n.d.). How big is the backlog where you live? New York, NY: Joyful Heart Foundation.

Feeney, H., Campbell, R. & Cain, D. (2018). Do you wish to prosecute the person who assaulted you?: Untested sexual assault kits and victim notification of rape survivors assaulted as adolescents. *Victims & Offenders, 13*(5), 651-674.

Fisher, B. S., Cullen, F. T., & Turner, M. G. (2000). The sexual victimization of college women (NCJ 182360). Washington, DC: United States Department of Justice, US Government Printing Office.

Florida Department of Law Enforcement. (n.d.). Assessment of unsubmitted sexual assault kits: Executive summary.

Gross, S. R., & Shaffer, M. (2012). *Exonerations in the United States, 1989–2012: Report by the National Registry of Exonerations*. University of Michigan Public Law Working Paper (277). Ann Arbor: University of Michigan.

Human Rights Watch. (2009). *Testing justice: The rape kit backlog in Los Angeles city and county.* New York, NY.

Human Rights Watch. (2010). *"I used to think the law would protect me": Illinois's failure to test rape kits.* New York, NY.

Indiana State Police. (2017). *A report of the findings and recommendations from an audit of untested sexual assault examination kits in the state of Indiana in accordance with Senate Resolution No. 55.* Indianapolis, IN: Indiana State Police.

Iowa Attorney General. (n.d.). Iowa sexual assault kit initiative inventory report. In (Vol. 2019). Des Moines, IA: Iowa Attorney General.

Joyful Heart Foundation. (2019). Where the backlog exists and what's happening to end it. New York, NY.

Kaplan, J. (2019a). Jacob Kaplan's concatenated files: Uniform Crime Reporting program data: Law enforcement officers killed and assaulted (LEOKA) 1960-2017. Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

Kaplan, J. (2019b). Jacob Kaplan's concatenated files: Uniform Crime Reporting Program data: Offenses known and clearances by arrest, 1960-2017. Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

Krebs, C. P., Lindquist, C. H., Warner, T. D., Fisher, B. S., Martin, S. L., & Childers, J. (2009). College women's experiences with sexual assault before and since entering college. *J Am Col Health, 57*, 639-649.

Lovell, R., Huang, W., Overman, L., Flannery, D., & Klingenstein, J. (2019). Offeding histories and typologies of suspected sexual offenders identified via untested sexual assault kits. *Criminal Justice and Behavior, 47*(4), 470-486.

Lovell, R., Luminais, M., Flannery, D.J., Bell, R., & Kyker, B. (2018). Describing the process and quantifying the outcomes of the Cuyahoga County sexual assault kit initiative. *Journal of Criminal Justice, 57*, 106-115.

Lovell, R., Luminais, M., Flannery, D.J., Overman, L., Huang, D., Walker, T., & Clark, D. R. (2017). Offending patterns for serial sex offenders identified via the DNA testing of previously unsubmitted sexual assault kits. *Journal of Criminal Justice, 52*, 68-78.

Lovrich, N., Pratt, T., Gaffney, M., & et al. (2004). *National Forensic DNA Study Report, Final Report*. Washington, DC: Department of Justice.

National Center for Education Statistics Integrated Postsecondary Education Data System. (n.d.). Washington, DC: U.S. Department of Education.

Patterson, D., & Campbell, R. (2012). The problem of untested sexual assault kits: Why are some kits never submitted to a crime laboratory? *Journal of Interpersonal Violence, 27*, 2259-2275.

Peterson, J.L., Hickman, M.J., Strom, K.J., & Johnson, D.J. (2013). Effect of forensic evidence on criminal justice case processing. *Journal of Forensic Sciences, 58*(S1), S78-S90.

Roman, J.K., Reid, S., Reid, J., Chalfin, A., Adams, W., & Knight, C. (2008). *The DNA field experiment: Cost-effectiveness analysis of the use of DNA in the investigation of high-volumne crimes*. Washington, D.C.: Urban Institute.

Schuck, A.M. (2017). Female officers and community policing: Examining the connection between gender diversity and organizational change. *Women & Criminal Justice*, *27*(5), 341-362.

Sexual Assault Kit Initiative. (2019). Performance metrics and research. Washington, DC: Bureau of Justice Assistance, Office of Justice Programs, U.S. Department of Justice.

Shaw, J., & Campbell, R. (2013). Sexual assault kit (SAK) submission among adolescent rape cases treated in forensic nurse examiner programs. *Journal of Interpersonal Violence, 28*, 3400-3417.

Sinozich, S., & Langton, L. (2014). Rape and sexual assault victimization among college-age females, 1995-2013. Washington, DC: Bureau of Justice Statistics.

State of Hawaii, Department of the Attorney General. (2016). Report on untested sexual assault evidence collection kits retained by county police departments, plans and procedures for the disposition of currently untested kits and new kits, and related information. Submitted to The Twenty-Ninth State Legislature Regular Session of 2017. Honolulu, HI: State of Hawaii.

State of Nevada, Office of the Attorney General. (2017). Semiannual sexual assault kit initiative report. Carson City, NV: State of Nevada.

Strom, K. J., & Hickman, M. J. (2010). Unanalyzed evidence in law enforcement agencies: A national examination of forensic processing in police departments. *Criminology and Public Policy, 9*, 381-404.

Sulley, C., Wood, L., Cook Heffron, L., Westbrook, L., Levy, N., Donde, S. D., & Busch-Armendariz, N. (2018). "At least they're workin' on my case?" Victim notification in sexual assault "cold" cases. Forthcoming in *Journal of Interpersonal Violence*.

TEST400k. (2016). Test400k launches dynamic “just track it” campaign to highlight appalling treatment of rape kit evidence & a national call to action. Chicago, IL.

The White House. (2015). Fact sheet: Investments to reduce the national rape kit backlog and combat violence against women. Washington, DC: The White House.

Ullman, S. E., & Townsend, S. M. (2008). What is an empowerment approach to working with sexual assault survivors? *Journal of Community Psychology, 36*(3), 299-312.

U.S. Senate. (2004). Innocence Protection Act of 2004. Washington, DC: U.S. Government Printing Office.

Wang, C., & Wein, L. M. (2018). Analyzing approaches to the backlog of untested sexual assault kits in the U.S.A. *Journal of Forensic Sciences, 63*, 1110-1121.

Wells, W., Fansher, A.K., & Campbell, B.A. (2019). The results of CODIS-hit investigations in a sample of cases with unsubmitted sexual assault kits. *Crime & Delinquency, 65*(1), 122-148.

WiSAKI (WI Sexual Assault Kit Initiative). (n.d.). Reasons previously unsubmitted sexual assault kits (SAKs) are not currently designated for DNA testing. Madison, WI: Wisconsin Department of Justice.

TABLES

Table 1. County Sample of Unsubmitted SAK Counts

State	No. of Counties/County Equivalents That Provided Data[a]	Year of Unsubmitted SAK Count/Audit
Alaska	29	2018
Arizona	15	2016
Connecticut	8	2015
Florida	67	2015
Hawaii	5	2016
Indiana	91	2017
Iowa	99	2016
Kentucky	120	2015
Michigan	83	2016
New Mexico	33	2018
Nevada	17	2017
North Carolina	100	2017
Virginia	133	2015 & 2017[b]
Washington	39	2018
Wisconsin	72	2017

Abbreviation: SAK, sexual assault kit.

[a] For all states but Indiana, 100% of counties reported data. Ninety-nine percent of counties in Indiana reported.

[b] See Appendix A for a description of how we combined Virginia's two SAK inventories.

Table 2. Model Estimates of the National Unsubmitted SAK Count

Analytic Model	National Unsubmitted SAK Estimate	95% Confidence Interval
Model 1: Naïve model	274,000	247,000–302,000
Model 2: Data-driven model	339,000	292,000–387,000
Model 3: Theoretical model	347,000	282,000–412,000

Abbreviation: SAK, sexual assault kit.

Table 3. All Model Covariate Results

Covariates		Direction of Effect[a]	Wald Chi-Square Statistic
	Naïve Model		
Logistic regression	Population	+	67.26
	Population*population	-	35.21
Poisson regression	Population	+	759.66
	Population*population	-	364.60
	Data-Driven Model		
Logistic regression	Population	+	58.23
	Population*population	-	32.23
	Legislation to track kits before 2018	-	23.98
	% Housing in structures with 10+ units	+	13.27
Poisson regression	Population per area in square miles	-	6171.76
	Property index offenses per population	+	2409.51
	Violent index offenses per population	+	2037.42
	Rapes per population	-	1756.08
	% Occupied housing units with more people than rooms	+	1255.57
	% Civilians 16 or older who are unemployed	-	1108.30
	Unsubmitted SAK inventory conducted prior to 2018 with legislation	-	1075.28
	% Single parent households with children under 18	+	804.01
	Population*population	-	535.06
	% Population uninsured	+	485.59
	Population	+	458.86
	Victims' rights to notice legislation before 2018	+	448.20
	% Mobile homes	-	400.21
	Legislation to track kits before 2018	-	361.45
	Daytime population per population	+	358.81
	% Population age 17 or younger	-	280.02
	% Persons in institutionalized group quarters	-	224.91
	% Households with no vehicle	-	168.45
	Population per housing units	+	142.61
	Female students enrolled per population	+	137.55
	State funding to address SAK backlog prior to 2018	-	126.93
	% Population that speaks English less than well	-	124.63
	% Persons age 25+ with no high school diploma	-	85.49
	% Population minority	-	74.34
	Female officers per total officers	-	63.50
	Officers per population	+	47.69
	% Population below poverty	+	20.60

	% Population with a disability	+	18.69
	Per capita income	-	15.20
	Legislation requiring the testing of SAKs before 2018	-	14.72
	Unsubmitted SAK inventory conducted prior to 2018 without legislation	+	12.63
	% Population 65 or older	-	4.41
	Theoretical Model		
Logistic regression	Population	+	44.88
	Female students enrolled per population	+	4.78
	% Population below poverty	+	4.69
	Legislation requiring the testing of SAKs before 2018	-	n.s.
	% Population minority	-	n.s.
	Unsubmitted SAK inventory conducted prior to 2018 without legislation	+	n.s.
	% Population age 65+	-	n.s.
	Unsubmitted SAK inventory conducted prior to 2018 with legislation	+	n.s.
	% Population that speaks English less than well	+	n.s.
	Per capita income	+	n.s.
	State funding to address SAK backlog prior to 2018	-	n.s.
	Population per area in square miles	+	n.s.
	Female officers per total officers	+	n.s.
	% Population 17 or younger	-	n.s.
	Officers per population	+	n.s.
	Rapes per population	+	n.s.
	Violent index offenses per population	-	n.s.
Poisson regression	Violent index offenses per population	+	7078.62
	Population per area in square miles	-	6627.92
	Rapes per population	-	1376.55
	Legislation requiring the testing of SAKs before 2018	-	1046.04
	% Population minority	+	901.25
	% Population 65 or older	-	760.95
	Female students enrolled per population	+	597.89
	% Population 17 or younger	-	230.73
	% Population below poverty	-	224.77
	State funding to address SAK backlog prior to 2018	-	105.00
	Unsubmitted SAK inventory conducted prior to 2018 with legislation	-	79.82
	Unsubmitted SAK inventory conducted prior to 2018 without legislation	+	67.58
	Officers per population	+	24.83

	% Population that speaks English less than well	+	19.87
	Per capita income	+	11.50
	Female officers per total officers	+	n.s.
	Population	+	n.s.

a. A value of + means that the log odds of unsubmitted SAKs increase as the predictor increases. A value of – means that the log odds of unsubmitted SAKs decrease as the predictor increases. The effect of each covariate should be interpreted as the county-level association between the covariate and the number of unsubmitted SAKs after every other relationship in the model is controlled for.

APPENDIX A

Alaska: We obtained agency-level data on unsubmitted SAKs from the Department of Public Safety's report of Alaska's statewide inventory (Alaska Department of Public Safety, n.d.). We generated county-level counts by matching agencies to counties using both the Uniform Crime Reporting (UCR) county offense files and information online, and then summing agency counts within counties.

Arizona: We obtained agency- and county-unsubmitted SAK counts from the Arizona Sexual Assault Evidence Collection Kit Task Force (azgovernor.gov, 2016).

Connecticut: We obtained agency-level counts of unsubmitted SAKs from the 2015 Connecticut Sexual Assault Crisis Services Report, *Untested: Eliminating the Backlog of Sexual Assault Evidence Collection Kits in Connecticut.* We generated county-level counts by using the UCR county offense files to match agencies to counties and summing agency counts within counties.

Florida: We obtained county-level unsubmitted SAK counts from the Florida Department of Law Enforcement's statewide assessment. We used the number of kits not submitted for analysis, which does not include kits from non-reporting victims (Florida Department of Law Enforcement, n.d.).

Hawaii: We obtained agency- and county-level unsubmitted SAK counts from the Department of the Attorney General's report (State of Hawaii, 2016). The date range of SAKs included in the counts varies by county. For each county, the end data was June 30, 2016, but the start date was either 1992, 1999, 2001, or 2001. Kalawao County did not appear in the report, but we assigned the county a value of zero because it has a population of around 100 persons and no independent law enforcement agency (LEA).

Indiana: In their report to the Legislative Council, the Indiana State Police provided county-level unsubmitted SAK counts (Indiana State Police, 2017). The report refers to these SAKs as "untested," but they had not been submitted for testing by the time of the audit. We combined the number of kits stored at medical centers and the number of kits stored in LEAs' evidence facilities.

Iowa: We obtained agency-level counts of unsubmitted SAKs from a statewide audit performed by the Crime Victim Assistance Division of the Iowa Department of Justice and its report of findings (Iowa Attorney General, n.d.). We used the UCR county offense files to match each agency to its county, and then summed agency counts by county to create county-level counts.

Kentucky: The number of unsubmitted SAKs by agency is available from the state auditor's report (Edelen, 2015). Although the report references "untested" kits, the survey asked LEAs to report the number of SAKs in their possession, so these are really unsubmitted SAKs. We were able to obtain county-level counts of backlogged SAKs from a site liaison to the Sexual Assault Kit Initiative (SAKI).

Michigan: We obtained county-level unsubmitted SAK counts from a Michigan SAKI liaison and consulted Michigan's SAKI inventory certification form for additional information on their inventory.

New Mexico: From a New Mexico SAKI site liaison, we received agency-level counts of unsubmitted SAKs. Using the UCR county crime files, we assigned each agency to its county and created county-level unsubmitted SAK counts.

Nevada: We obtained county counts of backlogged SAKs from a statewide audit conducted in the beginning of 2015 (State of Nevada, 2017).

North Carolina: Through the state department of justice's participation in the SAKI, we obtained agency-level counts of SAKs that were complete but had not been submitted for forensic testing. Next, we summed agency counts by county to obtain county-level counts. If an agency served multiple counties, we divided the agency's count evenly across its counties.

Virginia: Virginia conducted two inventories. In 2015, all unsubmitted SAKs collected before July 1, 2014, were inventoried. In 2017, all unsubmitted SAKs collected from July 1, 2014, through June 30, 2016, were inventoried. We combined agency counts across these two inventories to create agency-level counts at midyear 2016. Next, we used the UCR's county crime datafiles to obtain each agency's county, and then summed agencies within counties to generate county-level unsubmitted SAK counts. Although it is possible that by the time of the second inventory agencies had tested some of their unsubmitted kits from the first inventory, the prompt testing of SAKs was not required by law until after July 1, 2016.

Washington: Through the state's attorney general's office's participation in the SAKI, we obtained agency- and county-level unsubmitted SAK counts.

Wisconsin: We obtained agency-level counts of previously unsubmitted SAKs from the Wisconsin Sexual Assault Kit Initiative (WiSAKI) website (WiSAKI (WI Sexual Assault Kit Initiative), n.d.). Using an agency-county map provided on the WiSAKI website, we assigned each LEA to a county and created county-level summations of unsubmitted SAK counts. We included only SAKs that were designated for testing in our county counts, which excludes sexual assaults for which the victim did not consent to testing, the suspect was convicted for the incident and already had DNA in the Combined DNA Index System (CODIS), the suspect was acquitted or found not guilty, and more (WiSAKI (WI Sexual Assault Kit Initiative), n.d.).