Journal of Community Medicine & Public Health
Marquez E, et al. J Community Med Public Health 6: 262.
www.doi.org/10.29011/2577-2228.100262
www.gavinpublishers.com

Research Article

Improving the Identification of Children with Elevated Blood Lead Levels: A Pilot Project Using an Academic Detailing Approach

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Citation: Marquez E, Haboush-Deloye A, López EB (2022) Improving the Identification of Children with Elevated Blood Lead Levels: A Pilot Project Using an Academic Detailing Approach. J Community Med Public Health 6: 262. DOI: 10.29011/2577-2228.100262

Received Date: 07 October, 2022; **Accepted Date:** 17 October, 2022; **Published Date:** 21 October, 2022

Abstract

Despite known health consequences of lead exposure such as cognitive impairment and behavioral problems, childhood lead testing rates remain low in western US states, particularly in Nevada. Efforts to encourage pediatricians to increase childhood blood lead testing in marginalized communities may be thwarted by misperceptions of minimal lead exposure risk. The academic detailing approach-which uses an interactive educational outreach strategy to medical providers-may help increase childhood lead testing among pediatricians. The goal of this study was to assess the utility of academic detailing to increase blood lead testing in children under six. A secondary data analysis was conducted using 2018 and 2019 blood lead testing data to examine the effectiveness of academic detailing sessions with pediatric providers compared to mailing educational materials. Academic detailing sessions were provided to local pediatricians which included an overview of lead exposure risk, associated health risks of exposure, recommended blood lead testing guidelines for children under six, and legal reporting requirements. After the academic detailing visit, the blood lead testing rate was followed prospectively and compared to practices that only received educational materials by mail. Although individual providers indicated that AD sessions were useful and they were committed to following CDC recommendations, increases in testing were not statistically significant as compared to the control group. A longer follow up period might have had different results, but was not possible due to COVID-19. Academic detailing shows promise as a method to increase lead testing, but further studies must be conducted.

Keywords: Academic detailing; Clinicians; Educational outreach; Health promotion; Lead poisoning prevention

Introduction

The CDC estimates that over 500,000 children under age six who reside in the US have Elevated Blood-Lead Levels (EBLLs) [1]. Marginalized populations are most likely to experience EBLLs including racial/ethnic minorities, immigrants, refugees, and low-income populations [2-5]. Despite known health consequences to lead exposure such as cognitive impairment [6] and behavioral problems [7], childhood lead testing rates remain low. This is especially true in western states where it is estimated that three times as many children with EBLLs are missed than are diagnosed [8]. Furthermore, Nevada has one of the lowest lead testing rates in

the US—testing only 3% of children under six years old [9].

Identifying children with EBLLs remains a critical secondary prevention strategy to mitigate the impacts of lead exposure. Like other public health interventions, identifying children with EBLLs requires a multifaceted approach. Specifically, it includes establishing lead testing policies, education and outreach to community members to promote lead testing, and health care access that incorporates social and economic determinants in the prevention, identification, and treatment of disease. The impact of these strategies may be constrained, however, if medical providers remain unaware of lead testing policies and the importance of lead testing. Notably, medical providers are primarily the ones who identify children with EBLLs [10] and have the most influence in getting children tested for lead. As such, it is important for medical providers to get to know their patients to assess the social, cultural, and socioeconomic factors that may increase their lead exposure risk.

Jurisdictions with low testing rates may experience substantial challenges to increasing testing. For instance, in Nevada 48% of medical providers did not fully comply with CDC lead testing guidelines for children under six years old [10], some medical providers were misinformed by colleagues about standard testing practices [10], and others mistakenly believe that only children living in substandard housing were at risk for lead exposure [10]. Additionally, a lack of testing enforcement policies contributes to low testing rates [8] and poses a challenge to efforts to increase testing.

Low testing rates in Nevada may be partly explained by medical providers' lack of familiarity with local traditional and non-traditional sources of lead exposure. For instance, while most medical providers know that older homes can contain lead-based paint, they may assume that older housing with lead-based paint is only a relevant concern in eastern US states [11]. However, nearly 25% of homes in Nevada were built before residential lead-based paint was banned in the US [9]. Furthermore, one analysis in Henderson, NV, found nearly twice the rate of lead hazards in older homes than the national average [12]. Relatedly, medical providers may not be well-versed in non-traditional sources of lead exposure found in household items such as plastic toys [13], spices [14], folk remedies [15], and occupational take-home lead [16], all of which pose lead hazards to children.

Given the persistent challenges to increasing childhood lead testing, it is apparent new strategies need to be employed. Academic Detailing (AD) may be such an approach. AD is an interactive educational outreach strategy to medical providers to present unbiased, evidence-based information to improve patient care [17]. Through AD sessions, health educators help increase medical providers' knowledge and support behavior change [17]. To inform the behavior change processes, AD synthesizes insights from theoretical models such as the transtheoretical model of behavior change and social cognitive learning theory [17]. The AD approach is flexible and lends itself to being adapted to various health issues [18]. For instance, use of the AD approach has resulted in measurable differences in medical provider behavior, including reductions in inappropriate prescribing of antibiotics [19,20] and non-steroidal anti-inflammatory drugs [17], increases in routine HIV testing rates [21], more cost-efficient and appropriate use of blood products [22], and enhanced early detection of dementia [23].

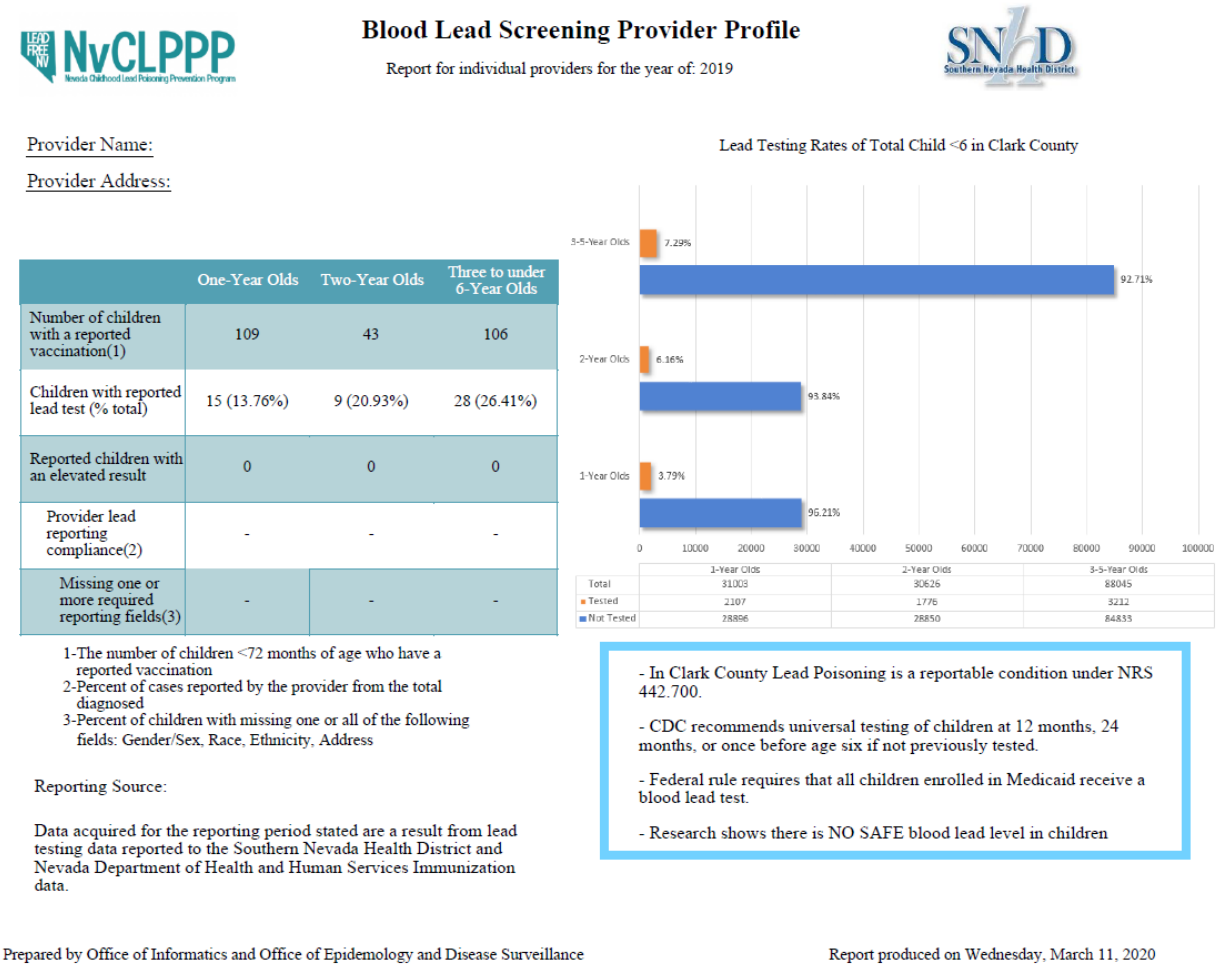
While AD has been adapted for various public health issues, no study to date has assessed the effectiveness of such a model to strengthen lead testing in children under six years old. AD may play an important role for lead poisoning prevention efforts as medical providers are at the forefront of early detection of childhood lead exposure. As such, the purpose of this study was to examine the effectiveness of AD to increase BLL testing by medical providers.

Materials and Methods

A secondary data analysis was conducted using 2018 and 2019 blood lead testing data to examine the effectiveness of academic detailing sessions with pediatrics providers compared to mailing educational materials. This study was approved by the Institutional Review Board of the University of Nevada Las Vegas protocol 1768587-1.

Procedures

The original data used in this study was collected through the Nevada Childhood Lead Poisoning Prevention Program (NvCLPPP) in Clark County, Nevada, the most populous county in the state. In partnership with NvCLPPP, the local health district produced a report card for each pediatric practice in Clark County using open-source Business Intelligence Software, Pentaho. The report card (Figure 1) provided the percentage of children who received a lead test at a given pediatric practice and was derived from the number of children with a lead test (numerator) and the number of children vaccinated (denominator). The lead testing percentage at each pediatric practice was stratified by age. Report cards showed childhood lead testing rates for both the pediatric practice and the average testing rate in Clark County so that providers could compare their practice's performance. A total of 142 practices had viable vaccination data to generate report cards. The 2018 report card data served as the baseline measure of lead testing before project implementation, and the 2019 report data served as the post-AD measure.



Blood Lead Screening Provider Profile

Report for individual providers for the year of: 2019

Provider Name:

Provider Address:

	One-Year Olds	Two-Year Olds	Three to under 6-Year Olds
Number of children with a reported vaccination(1)	109	43	106
Children with reported lead test (% total)	15 (13.76%)	9 (20.93%)	28 (26.41%)
Reported children with an elevated result	0	0	0
Provider lead reporting compliance(2)	-	-	-
Missing one or more required reporting fields(3)	-	-	-

1-The number of children <72 months of age who have a reported vaccination
2-Percent of cases reported by the provider from the total diagnosed
3-Percent of children with missing one or all of the following fields: Gender/Sex, Race, Ethnicity, Address

Reporting Source:

Data acquired for the reporting period stated are a result from lead testing data reported to the Southern Nevada Health District and Nevada Department of Health and Human Services Immunization data.

Lead Testing Rates of Total Child <6 in Clark County

	1-Year Olds	2-Year Olds	3-5-Year Olds
Total	31003	30626	88045
Tested	2107	1776	3232
Not Tested	28896	28850	84833

- In Clark County Lead Poisoning is a reportable condition under NRS 442.700.

- CDC recommends universal testing of children at 12 months, 24 months, or once before age six if not previously tested.

- Federal rule requires that all children enrolled in Medicaid receive a blood lead test.

- Research shows there is NO SAFE blood lead level in children

Prepared by Office of Informatics and Office of Epidemiology and Disease Surveillance

Report produced on Wednesday, March 11, 2020

Figure 1: Medical Practice Report Card.

From 142 pediatric practices with report cards, a subset of practices was assigned to the intervention group (n=69) to receive an academic detailing session and educational materials. Pediatric practices were assigned to the intervention group if they were located in zip codes with high risk for lead exposure. NvCLPPP's Lead Exposure Risk Index was used to determine priority zip codes by accounting for the percentage of pre-1978 homes and the percentage of children living in poverty by zip code [9]. Pediatric practices in zip codes with a low risk for lead exposure were assigned to the control group (n=73) and were mailed a packet of educational materials. Educational materials provide "concise, decision support material to further encourage evidence-based clinical decisions" [24]. The packet included a report card for the pediatric practice and informational sheets that detailed sources and effects of lead exposure, recommended actions for EBLLs, and reporting requirements for blood lead tests.

Academic Detailing Sessions

The 69 pediatric practices located in priority zip codes were contacted to schedule an Academic Detailing (AD) session for all medical providers within the practice. Medical providers were defined as physicians, physician assistants, nurse practitioners, nurses, or medical assistants. AD sessions were provided by health educators who were specially trained in childhood lead exposure, testing and reporting. Before AD sessions, the health educators administered a brief 8-item survey, developed by program staff, to assess current blood lead testing practices.

The health educators then distributed educational materials, including the report card for the pediatric practice, and then covered key messages about sources and effects of lead exposure, recommended actions for EBLLs, and reporting requirements for blood lead tests. Key messaging on lead exposure

sources included an overview of non-traditional sources of lead exposure (e.g., glazed ceramics, spices, and cultural foods and medicines) and the traditional source (e.g., lead based paint in local zip codes with a high percentage of pre-1978 homes) that were directly relevant to the patient population. Another integral AD component was identifying potential barriers before the AD session [10] and preparing enabling messages to counter medical provider hesitancy to lead testing and reporting. When medical providers brought up barriers to testing such as "*This is not an issue at my clinic*", "*I don't have time*", and "*There is no real danger to lead exposure*", health educators responded with enabling messages such as "*The population you serve is among the highest of statistical risk for lead exposure*", "Testing removes the need for working a lead screening questionnaire and may save you time", and "New research is showing that exposure as low as 3.5 µg/dL can have serious health effects that may not be obvious during a visit and can only be found with a test".

During the AD sessions, health educators asked pre-established questions to generate active participation from medical providers as active participation has been shown to increase knowledge and behavior change [25]. Specifically, health educators asked medical providers if they had found any EBLLs in children at their practice, what their lead testing rate was, and their thoughts on potential performance gaps in testing. In addition, at the end of the AD session, medical providers were asked to complete a brief eight-question survey to assess their perceptions of the AD session. Examples of the survey questions include "The information session I received increased my familiarity with recommendations to test children" and "The information session increased my likelihood of encouraging and/or ordering a blood lead test for a child". The eight items were answered on a 5-point scale ranging from agree to disagree.

Data Analysis

Descriptive statistics were used to compare pre- and post-AD survey data, including blood lead testing practices, provider attitudes, and anticipated behaviors after the AD visit. Blood lead testing rates at each pediatric practice were compared between 2018 to 2019 to determine if there was an increase in testing. Fisher's two-tailed exact test was used to determine whether childhood lead testing increased in the intervention group compared to the control group. Pediatric practices were excluded from the final analysis if they received an academic detailing visit between October to December 2019 as it did not provide sufficient time to observe a change in blood lead testing. In addition, practices were also excluded if they had missing data for 2018 or 2019. All statistical analyses were performed in SPSS Statistics Version 26.

Results

Between April and September of 2019, NvCLPPP health educators provided AD sessions to 37 medical providers constituting 18 unique pediatrics practices. The average length of academic detailing sessions was approximately 20 minutes. During the same time frame, the education materials were mailed to 260 medical providers at the 73 pediatric practices assigned to the control group.

The majority of medical providers (n=27) who attended the AD sessions completed the brief survey (72.97% response rate). Two-thirds (66.66%) of providers indicated that they had a practice-wide policy for lead testing children (Table 1). However, the reported policies varied, and providers within the same office did not always report the same policy. The majority of medical providers (62.96%) indicated that their policy is to test every child at one and two years old, or at least once before age six. Concerning patient follow-through, 33.3% of providers indicated that 80% or more of patients completed their child's blood lead test. Providers reported that the most common barrier to patient compliance is off-site testing (37.04%), followed by time (29.63%), then transportation (29.63%).

	N	%
Office has a practice-wide policy for lead testing in children	18	66.66%
Office policy to test at 12 and 24 months	5	27.77%
Other office policy	7	38.88%
Provider Blood Lead Testing Criteria	27	
Every child at ages 1 and 2 or at least once before age 6	17	62.96%
Children who are Medicaid beneficiaries at age 1 and 2, or at least once before 6	5	18.52%

When a child is recommended for testing by a formal lead screening questionnaire	2	7.41%
Provider Lead Testing Guidelines Followed	27	
Centers for Disease Control and Prevention	18	66.67%
American Academy of Pediatrics Bright Futures	5	18.52%
None	1	3.70%
Percentage of Patients that Complete lead tests	27	
>80%	9	33.33%
50-70	8	29.63%
<30%	2	7.41%
<10%	2	7.41%
Barriers to patient compliance with an ordered blood lead test*	27	
Cost	5	18.52%
Off-Site Testing	10	37.04%
Transportation	8	29.63%
Time	8	29.63%
Patients don't think it's important	7	25.93%
Parents don't want a blood draw	3	11.11%
Language/lack of understanding	2	7.41%
Note: Missing responses are not reported in the table. *indicates that respondents could select multiple options.		

Table 1: Medical Provider Survey Results Regarding Blood Lead Testing Practices.

As depicted in Table 2, the post-AD survey results revealed that the majority of medical providers felt the AD sessions increased their knowledge of lead reporting requirements (84.6%) and sources of lead exposure (88.5%). Medical providers and staff also indicated that the AD sessions increased their likelihood of testing (84.6%) and found them useful (88.5%).

	Agree (1)	(2)	(3)	(4)	Disagree (5)
The information session I received increased my:					
Familiarity with recommendations to test children.	88.5%	11.5%	0.0%	0.0%	0.0%
Knowledge of the responsibilities and requirements of reporting lead testing results to the health district.	84.6%	15.4%	0.0%	0.0%	0.0%
Familiarity with the effects of childhood lead poisoning.	80.8%	7.7%	7.7%	3.8%	0.0%
Familiarity with sources of lead exposure.	88.5%	7.7%	3.8%	0.0%	0.0%

Familiarity with the recommended response actions to elevated blood lead levels.	80.8%	7.7%	7.7%	0.0%	3.8%
Familiarity with the resources available to the families of children with elevated blood lead levels.	88.5%	11.5%	0.0%	0.0%	0.0%
Likelihood of encouraging and/or ordering a blood lead test for a child.	84.6%	11.5%	3.8%	0.0%	0.0%
The information session was useful.	88.5%	11.5%	0.0%	0.0%	0.0%

Table 2: AD Session Survey Results from Medical Providers and Staff (n=26).

After excluding practices with incomplete data in either the 2018 or 2019 report cards, the final sample size included 13 pediatric practices in the intervention group and 47 pediatric practices in the control group. Fisher's exact test was used to determine if there was a significant association between increases in blood lead testing for children under two years old and academic detailing. As shown in Table 3, there was no statistically significant association between the two variables (two-tailed test; p=1.0). Fisher's exact test was also used to determine if there was a significant association between increases in blood lead testing for children under six years old and academic detailing. Similarly, there was no statistically significant association between the two variables (two-tailed; p=0.12).

	No testing increase from 2018-2019	Testing increase from 2018-2019	Total	P-value
Children < 2 years old			60	
AD group	8(61.5%)	5(38.50%)	13	p = 1.0
Control group	28(59.60%)	19(40.40%)	47	
Children < 6 years old			60	
AD group	9(69.20%)	4(30.80%)	13	p = 0.12
Control group	20(42.60%)	27(57.40%)	47	

Table 3: Changes in Childhood Blood Lead Level Testing by Age and Study Group.

Discussion

The primary goal of an AD approach is to improve medical provider decision-making by using unbiased, evidence-based information to improve patient outcomes. These pilot data demonstrated the need for further studies on the utility and effectiveness of AD as an approach to increase lead testing, particularly in low screening states.

Data collected on provider perceptions of AD visits after implementation provided encouraging results. Surveys showed that medical providers felt that their knowledge increased regarding the sources and effects of lead exposure, testing guidelines, and reporting requirements. Medical providers also indicated that they found the academic detailing session useful and increased their likelihood of ordering a blood lead test for a child. Pre-AD survey data provided a glimpse into disparate blood lead testing practices, office-wide policies for lead testing, and continued barriers to testing that provider's encounter. AD sessions provide an opportunity to continue engagement with medical providers on actionable items such as developing and adopting clinic-wide lead testing policies, and strategizing ways to decrease barriers to off-site testing for parents.

One chief purpose of this evaluation was to determine if AD increased the number of children tested for lead. Findings from this secondary data analysis show that 38.50% of practices increased the number of screenings after AD visits. The rise in desired behavior is consistent with past studies that have shown that academic detailing led to behavior change in medical providers [20-22]. However, when compared to the control group, findings were not statistically significant. Therefore, it is unclear which strategy is ultimately more effective. Nonetheless, both academic detailing and mailing educational materials can be used to increase childhood lead testing rates.

Overall, the AD model is an adaptable strategy that can promote behavior change in medical providers across a variety of

public health issues, including the promotion of childhood lead testing. However, AD requires considerable effort beforehand to carefully develop key messages that account for medical providers' needs and challenges related to the desired behavior change. For instance, in Clark County, previous research had identified a lack of knowledge of local lead risk and exposures [10]. Therefore, key messages were developed to provide local data on traditional and non-traditional exposures in marginalized communities so providers would prioritize lead testing during office visits with patients. An equally important component of this AD approach was the development of the "barriers and enablers" that pinpoint potential challenges and counter responses. Medical providers have very limited time, and AD is an approach that encourages active learning with relatable and contextualized information relevant to the physician that leads to behavior change [24].

Limitations

Our project had several limitations worth noting. First, most of the academic detailing sessions were done mid-year 2019; therefore, the 2020 data would have been a better indication of behavior change resulting from the AD visits. However, the COVID-19 pandemic interrupted the observation period by substantially reducing the number of individuals who sought in-person medical care. Additionally, the 2020 report card data were not available at the time of analysis because resources were diverted to address the pandemic. Therefore, this pilot needs to be replicated without the interruption of a worldwide crisis to truly understand its potential. The pandemic also made in-person follow-up AD visits impossible, which could have led to more program success.

Second, to establish the percentage of children tested pre and post-intervention, data had to be tabulated at the medical practice-level rather than at the individual physician-level, making it challenging to assess testing behavior for each medical provider or to use individual data as a motivator for change. Third, the percentage of children tested for lead relies on matching children across two data sets, which is subject to data limitations. For instance, if children were lead tested but not vaccinated, they were not included in number of children tested for lead. Furthermore, if children changed practices, their immunization data and lead testing data could not be linked and, consequently, were excluded.

The fourth limitation pertains to the distribution of the practices to either the intervention or the control group. Unlike the intervention group, the control group was not located in the priority zip codes, making for less ideal comparisons. It may be that increasing testing in economically marginalized priority zip codes is more challenging than increasing testing in affluent, well-resourced zip codes. Finally, the last limitation is that AD visits were done with a group of medical providers rather than one-on-one, which is the recommended, traditional approach [22]. However, anecdotally, we found that physicians were more likely to ask questions and reveal when they were unsure of something during group sessions compared to one-on-one sessions, which may suggest that they were more engaged or comfortable in the group context. This finding should be further explored to determine the best approach for medical providers in priority zip codes.

Increasing childhood lead testing rates is complex and multifaceted. Because medical providers play a key role in this effort, there needs to be a strong emphasis on encouraging providers to increase childhood lead testing. However, this can be challenging given misperceptions of low lead exposure risks for children coupled with physician norms of not testing for lead exposure [10]. The AD model has potential to gain provider buy-in, which would support efforts to identify children early to mitigate the impacts of lead exposure. Future studies should explore the impact of AD visits on childhood BLL testing rates over a longer period, explore the impact of follow-up AD visits, and determine if there is a difference in using individual versus group AD sessions.

Implications for Policy & Practice

Academic detailing has been widely used in the pharmaceutical industry and has been slowly integrated in the field of public health. It shows promise to address a wide range of public health issues because it is systematic and highly adaptable. The academic detailing approach could be an effective method to educate and encourage providers to conduct blood lead tests, especially in low testing states where there is insufficient data to understand local risk factors. As we continue to navigate the best approaches to address preventable disease burdens, we must continually adapt methods and interventions that protect the health of our most marginalized and vulnerable community members.

Acknowledgements

This publication was supported by the Grant or Cooperative Agreement Number, 1 NUE2EH001366-01-00, funded by the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services. The authors do not have any conflicts of interest to disclose regarding this manuscript. This study was approved by the Institutional Review Board of the University of Nevada Las Vegas protocol 1768587-1. We would like to thank Josh Huebner and Belen Campos-Garcia for contributing to data collection and Tiana Tu, Rebecca Dunne, and Kacie Washburn for assisting with formatting.

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