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The prevalence of physical health problems among youth in the juvenile justice system: A systematic review.

Abstract

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Keywords

adolescents; juvenile justice; incarceration; health

Cover Page Footnote

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The Prevalence of Physical Health Problems among Youth in the Juvenile Justice System: A Systematic Review

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ABSTRACT

Justice-involved youth suffer from a range of health problems. Using health and social science databases, we summarize findings from studies reporting rates of physical health problems among youth in the juvenile justice system published between 2006 and 2017. A total of 23 were identified, with the majority examining sexual health problems and focusing on youth confined to correctional facilities. Although fewer studies focused on non-sexual health problems and non-detained youth, findings suggest disparities across some physical health problems impacting youth within various levels of justice system involvement. Given the health risks faced by justice-involved youth and their long-term consequences, more studies examining their physical health status is needed to create targeted interventions that address disparities for this high-risk group.

Keywords: Adolescents; Health; Juvenile justice; Incarceration

INTRODUCTION

Each year, over 45,000 youth in the United States (US) are detained or incarcerated (Office of Juvenile Justice and Delinquency Prevention [OJJDP], 2018), with even more receiving sentences of probation and community service alternatives to detention (OJJDP, 2018). Justice-involved youth are a high-risk group of adolescents who suffer from a range of behavioral and health challenges. Studies find that up to 70% of youth in the juvenile justice system have diagnosable mental health problems, including substance abuse disorders (Balogun, Triois, Swartz, Lloyd & Beyda, 2018; Schubert & Mulvey, 2014; Vincent, Grisso, Terry & Banks, 2008). Additionally, justice-involved youth have been found to have high rates of sexually transmitted infections (STIs). According to the Centers for Disease Control and Prevention (CDC), chlamydia rates among youth detained in correctional facilities were 6.9% for males and 15.3% for females (CDC, 2010). Similar rates have been found for non-detained adjudicated youth (Donaldson, Burns, Bradshaw, Ellen & Maehr, 2013).

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While the majority of studies on adjudicated youth have documented significant mental health, substance abuse, and to lesser extent sexual health problems, fewer studies have focused on health problems outside of these specific areas. However, several studies have suggested adjudicated youth have unmet health needs in the areas of oral health, trauma-related injuries and respiratory issues (Braverman & Morris, 2011; Feldmann, 2008). Additionally, researchers and health professionals have indicated that many incarcerated and detained youth lack adequate and consistent health care outside of the juvenile justice system, and receive much of their care while detained. Such studies and reports have noted various health services provided to adjudicated youth in detention and residential settings, including testing and treatment for STIs, immunizations, and treatment for asthma (Feldmann, 2008; Gallagher, Dobrin & Douds, 2007). While these reports provide a sense of the health needs of this population, much of the information has been based on providers' experiences and anecdotes (American Academy of Pediatrics, 2011). Despite limited documentation of health problems beyond mental health issues and substance abuse experienced by adjudicated youth, few empirical studies examining the prevalence of physical health problems among this population have been conducted.

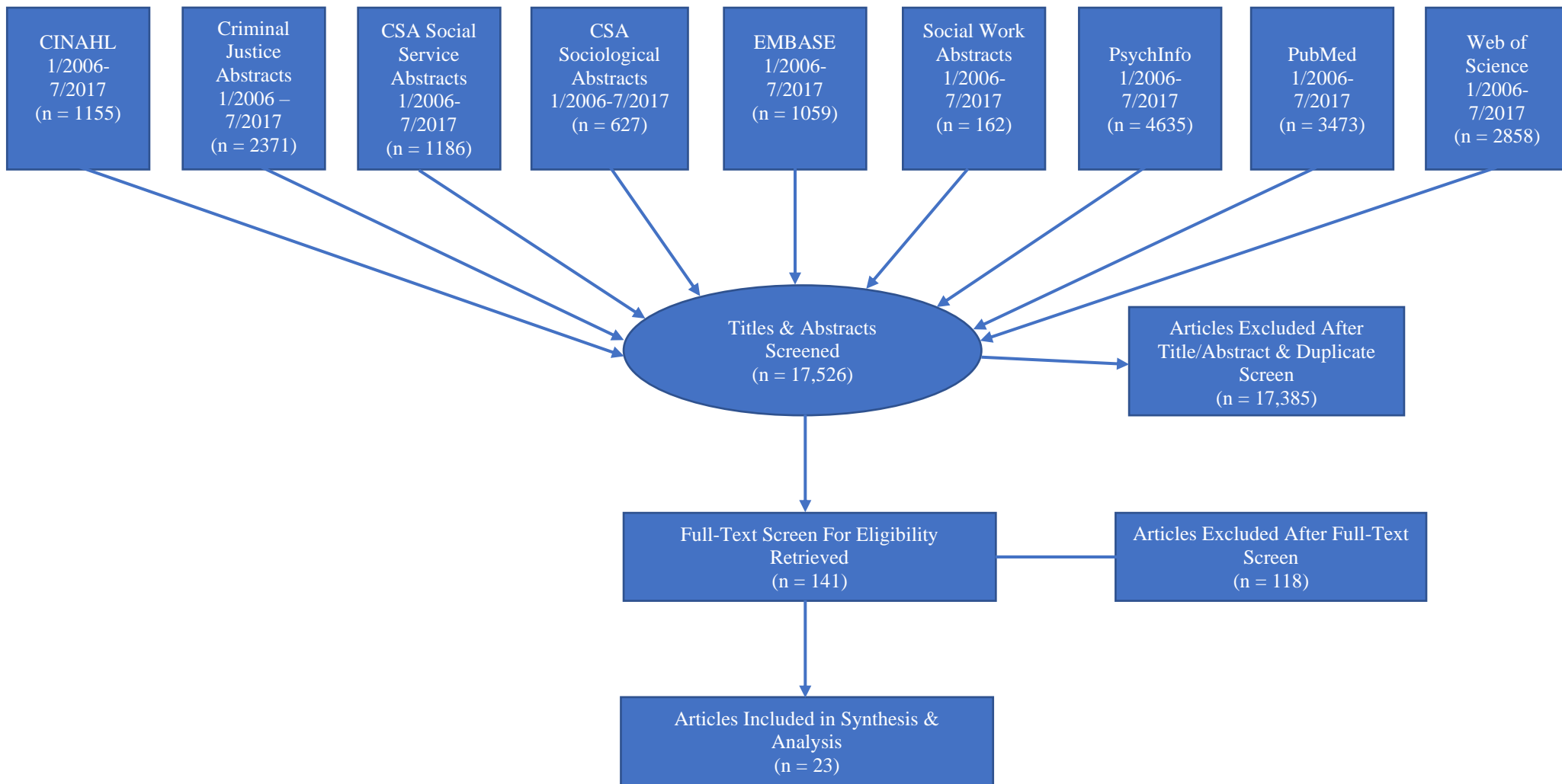
The purpose of this review is to provide a systematic examination of the physical health problems faced by justice-involved youth in the United States. The review provides an overview of physical health problems and associated prevalence rates identified in previous studies, including demographic differences in rates. When possible, rates of physical health problems identified among adjudicated youth are compared to those from youth in the general population. In many cases, comparison rates for the general population were reported in the research studies reviewed. When such comparative data were not provided, we reported rates for same-aged populations provided by national health centers, such as the Centers for Disease Control and Prevention (CDC) and the Department of Health and Human Services (DHHS). Additional information regarding the comparative general population can be found in Table 1. We examined empirical studies published from 2006 - 2017 indicating prevalence rates of physical health problems among adjudicated youth. Given the extant research on adjudicated youth's mental health and substance use, which is commonly considered a mental health problem, this review excludes these particular health areas. The following is a review of the physical health problems experienced by youth in the juvenile justice system. In addition, we outline important areas for further research and intervention.

METHODS

We conducted a systematic review of academic journals through a search of nine key databases covering a variety of academic disciplines studying youth in the juvenile justice system. These databases included PubMed, CINAHL, PsycINFO, Embase, Sociological Abstracts, Social Services Abstracts, Web of Science: Social Science, Criminal Justice Abstracts, and Social Work Abstracts. Search terms included keywords relating to the following three categories: 1) adolescents (i.e., 'adolescen*', 'youth', 'juvenile'), 2) juvenile justice system (i.e., 'incarcerated', 'adjudicated', 'detained', 'detention', 'probation', 'justice', 'offender'), 3) and physical health (i.e., 'health', 'health system', 'health care', 'health services', 'health utilization', 'treatment'). Searches were restricted to English language manuscripts published in peer-reviewed journals between January 2006 – July 2017.

All abstracts retrieved by searches were reviewed by the first author, and irrelevant references were discarded. Studies were selected for inclusion if they were empirical studies (excluding case studies and intervention studies) that reported rates of any physical health problem (including mortality) among youth under 18 years of age in the U.S. juvenile justice system (i.e., incarcerated, detained, probation, community sentencing, and arrested). Studies that examined populations outside of the selection criterion were included if they presented stratified results for the focal population. Studies were excluded if data for youth under 18 years were not disaggregated from that of individuals 18 years and older. For all health problems, a diagnosis by a health professional versus self-report of symptoms was needed for study inclusion. After eliminating duplicate studies identified across the nine different databases and examining titles and abstracts, 141 studies were identified for eligibility (see Figure 1). Each eligible article was then read by the two authors, screened according to the inclusion criteria, and selected for inclusion in the review by discussion and consensus. Two authors extracted the following data for each article: sample size, type of adjudication (e.g., detention, probation, arrested, incarcerated, etc.), study design and diagnostic method, type of physical health problem, gender, race/ethnicity, age, and rates of the health problem of interest. Any discrepancies regarding the extracted data was resolved by discussion.

Figure 1. Systematic Review Flow Chart



RESULTS

Based on the review criteria, a total of 23 studies were selected for inclusion (see Table 1). Several studies focused on multiple physical health outcomes. However, the majority of studies (n = 13) focused on STIs. Other health problems represented include: overweight/obesity (n = 3), asthma (n = 2), injury (n = 4), pregnancy (n = 2), mortality (n = 2), diabetes (n = 1), oral health (n = 1), high blood pressure (n = 1), pelvic inflammatory disease (PID) (n = 1), and lack of immunizations (n = 1). The studies also included a range of justice-involved youth, with the majority of studies focusing on youth in secure correctional facilities (i.e., detention, jail, prison) (n = 17). The remaining studies examined physical health problems among court-involved youth (n = 1), probation youth (n = 1), arrested youth (n = 1), youth in community-based alternatives (n = 1), as well as a combination of adjudicated youth (n = 2).

Table 1. Summary of research on physical health problems among justice-involved youth

Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
Aalsma et al., 2011	1,181 detained youth (13-18 years old) in Marion County, Indiana	Cross-sectional/ On-site screening	*STI -Chlamydia -Gonorrhea -Trichomonas	*Gender *Race/ ethnicity	*14% tested positive for any STI *Girls 3x more likely to test positive than boys *Black youth 2x more likely to test positive than white youth
Barskey et al., 2016	8,626 youth (13-19 years old) tested in correctional facilities across the United States between 2008-2011 8382 youth (13-19 years old) tested in non-correctional facilities in the United States between 2008-2011	Cross-sectional/ CDC's National HIV Surveillance System	*HIV	*Age *Gender *Race	*2.4% newly diagnosed with HIV

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
Bolin et al., 2006	419 detained youth (12-17 years old) in Dallas County, Texas Non-detained youth matched from the Third National Health and Nutrition Examination Survey	Cross- sectional/ Medical Records	*Oral Health -Dental carries -Need of dental sealants -Decayed, missing, filled teeth (DMFT)	*Age *Gender *Race/ ethnicity	*Detained youth had a higher percentage of DMFT than youth from the national sample *86% needed dental sealants on permanent molars *49.6% had untreated dental decay *74% experienced dental carries
Burghardt et al., 2016	59,518 female STI test records (10- 19 years old) in California Juvenile Detention Facilities between 2003-2014	Cross- sectional/ On-site screening	*Chlamydia	*Age *Race/ ethnicity	*14.8% tested positive in 2004 and 11.5% tested positive in 2014 *Black females had higher positivity than white and Hispanic females
Dembo et al., 2009	506 male and 442 female newly arrested youth (12-18 years old) at the Hillsborough County Justice Assessment	Cross- sectional/ On-site screening	*STI -Chlamydia -Gonorrhea	*Age *Gender	*girls (19.5%) had higher STI rates than boys (10.75%) *Chlamydia rates were 12.4% for females and 7.7% for males *Gonorrhea rates were 2.5% for females and 1.4% for males

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
	Center in Tampa, Florida				
Feinstein et al., 2007	425 youth detained in longer-term juvenile correction facilities in Louisiana	Cross-sectional/ Medical records	*Overweight	*Age *Gender *Race/ ethnicity	*0% of youth were underweight *6.6% of males and 18.4% of females were overweight *5.8% of African American males and 19.1% of African American females were overweight *10.6% of non-Hispanic white males and 14.3% of non-Hispanic white females were overweight *Significant gender differences found among African American youth
Frye et al., 2008	6,367 detained males and 874 detained females (12-19 years old) in an Illinois juvenile detention center	Cross-sectional/ Medical Records	*STI -Chlamydia -Gonorrhea *Pregnancy	*Age *Gender *Race/ ethnicity	*10.3% of youth (8.9% of males, 20.8% females) tested positive for chlamydia *18.5% of youth (16.8% of males, 24.3% of females) who tested positive for chlamydia also tested positive for gonorrhea *6.1% of youth with a confirmed pregnancy status tested positive for pregnancy
Gallagher et al., 2006	62 death records of youth (ages 20 years old and under) in U.S. juvenile justice residential	Cross-sectional/ JRF Census Records	*Mortality	*Age *Gender *Race/ ethnicity	*62 deaths occurred *Suicide was the leading cause of death (n=20) *Overall rate for youth in residential care (.072%) was slightly higher than youth from the general population (.067%)

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
	facilities (JRF) between 2000- 2002 CDC national death rate estimates of general population youth				*Suicide rate for youth in residential care (.021%) was higher than youth from the general population (.007%) *Deaths by homicide and accidents were lower for youth in residential care than for general population youth (.007% vs. .09% and .018% vs. .032% for homicidal and accidental deaths, respectively)
Gaskin et al., 2015	249 youth (11-19 years old) in a juvenile detention facility in Northern California between 2011- 2012 Matched California data from the 2011 National Immunization Survey-Teen (13- 17 years old)	Cross- sectional/ Medical Records	*Immunizations - Tdap - HepA - VZV - MCV4 - HPV	*Age *Gender *Race/ ethnicity	*Detained youth had lower coverage for all vaccines than general population youth in California *Prior to first detention 3% of detained youth completed, and 3% were on track for completing the recommended immunizations *Prior to first detention 38% of females and 8% of males completed HPV immunizations *Detained girls less likely to have initiated or completed HPV series prior to first detention than general population youth *Youth with multiple detainments had higher coverage rates than youth from the general population
Gordon et al., 2017	3,101 youth in probation centers and correctional	Cross- sectional/	*Traumatic Brain Injury (TBI)	*Age *Gender *Race/	*22% of youth met criteria for TBI. *Of those meeting criteria, 56.3% had mild TBI, 43.7% had moderate-severe TBI

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
	facilities in 5 Texas counties (Bexar, Cameron, El Paso, Harris, and Lubbock)	On-site screening		ethnicity	*Frequency of TBI was higher for females (28.4%) than males (21.3%) *Older and white youth were more likely to be have TBI
Joesoef et al., 2009	23,339 female and 74,342 male chlamydia tests (12-17 years old) from 163 correctional facilities across 29 states in 2005	Cross-sectional/ On-site screening	*Chlamydia	*Age *Gender *Race/ ethnicity	*14.3% of females and 6% of males tested positive *Prevalence rates increased with age for males (2.4% for 12-14 years, 8.7% for 15-17 years) *non-Hispanic Black youth had the highest prevalence (females: 18.4% Black vs. 13.3% Hispanic and 10% non-Hispanic white; males: 9.6% Black vs. 5.3% Hispanic and 2.8% non-Hispanic white)
Johnson et al., 2008	1,594 youth placed on probation under family court in Philadelphia, PA	Cross-sectional/ On-site screening	*STI -Chlamydia -Gonorrhea	*Age *Gender	*8.4% of youth tested positive for chlamydia only (12% females, 6% males) *7.2% of youth tested positive for gonorrhea only (1.3% females, .5% males) *.6% of youth tested positive for both chlamydia and gonorrhea (.6% females, .5% males) *8.4% of youth tested positive for one or both STDs (13.9% females, 7% males)
Kaba et al., 2014	300 male and 84 female youth	Cross-sectional/	*Head injury	*Age *Gender	*50% of males and 49% of females reported a history of at least one head injury

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
	detained (16-18 years old) newly admitted to the New York City Jail System in 2012	On-site screening	*Traumatic Brain Injury (TBI)		*32.5% had no or one minimal injury (25.5% male, 7% female) *49.7% had a TBI (39% male, 10.6% female) *TBI risk was 3,107 per 100,000 person-years *Assault (55.5%) and fall-related injuries (41%) were the most common causes
Keough et al., 2015	538 youth (19 years old and younger) entering juvenile justice facilities between 2010-2011 in a large metropolitan area in the northeast United States	Cross-sectional/ On-site screening	*Weight	*Age *Gender *Race/ ethnicity	*58.8% were normal weight *20.2% were overweight *20.6% were obese *no gender or racial/ethnic differences were found in weight status
Kerr et al, 2009	166 female youth (13-17 years old) mandated to community-based out of home care in Oregon	Cross-sectional/ Caregiver and Youth Report	*Pregnancy rates	*Age *Race/ ethnicity	*25.3% had a history of pregnancy
Lofy et al., 2006	3,588 female chlamydia tests (10-17 years old) from four juvenile facilities	Cross-sectional- On-site screening	*Chlamydia	*Age *Race/ ethnicity	*17.1% reported a positive test in the past year. *13.7% of tests performed during the study period were positive

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
	in WA between 1998-2002				
Odgers et al., 2010	141 females (18 years old and younger) incarcerated in a correctional facility in the southeastern United States	Cross-sectional/ On-site screening	*STI *Injury *Weight *Asthma	*Age *Race/ethnicity	*60.8% experienced injuries, with fractures (32.8%), self-injury (20.8%), head injury (18.4%) most common *Blunt trauma (14.5%), stab wounds (13.6%) and gunshot wounds (4.8%) were least common *42.3% tested positive for an STI (7.3% chlamydia, 7.3% pelvic inflammatory disease, 2.4% gonorrhea) *57.4% were overweight or obese *31.2% had asthma
Satterwhite et al., 2014	82,689 girls entering 126 juvenile detention centers across the United States between 2009-2011	Cross-sectional/ On-site screening	*Chlamydia	*region	*14.7% tested positive for chlamydia *37.7% reporting high positivity (over 15%) were located in the South. *42.6% reporting low positivity (less than 15%) were located in the West. *The Midwest (17%) had the highest positivity rate
Teplin et al., 2014	1,829 youth at the Cook County Juvenile Temporary Detention Center in Chicago, IL	Prospective, longitudinal/ Verified death certificates	*Mortality	*Gender *Race/ethnicity	*7% of males and 4% of females died during the study period *68% of deaths were due to homicides, with firearm being the most type of homicide *Mortality rates for males aged 15 to 19 years were 5x the general population rates

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
	between 1995-1998				*Mortality rates for females aged 15 to 19 years were 9x the general population rates *African-American males had the highest mortality rate, non-Hispanic white males had the lowest mortality rate
Torrone et al., 2016	1,771 girls (12-18 years old) entering a juvenile detention facility in San Diego, CA between 2009-2010	Cross-sectional/ Medical records	*Chlamydia	*Age *Race/ ethnicity	*10.3% tested positive *Prevalence was higher among youth aged 15-18 years *No statistically significant differences in rates by race/ethnicity were found
Vaughn et al., 2014	1,354 youth sentenced in juvenile or adult court systems in Phoenix, AZ and Philadelphia, PA	Longitudinal, prospective/ On-site screening	*Traumatic Brain Injury (TBI)	*Age *Gender *Race/ ethnicity	*30.3% of youth had TBI *Older, males and non-Hispanic white youth were more likely to report TBI
Voisin et al., 2013	123 African American females (14-18 years old) within eight detention facilities in Georgia	Cross-sectional/ On-site screening	*STI -Chlamydia -Gonorrhea	*Age	*25.6% tested positive for chlamydia *5.6% tested positive for gonorrhea *No gender differences in chlamydia and gonorrhea rates were found

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Study	Sample	Design/ Diagnostic Methods	Physical Health Problem	Covariates	Findings
Winkelman et al., 2017	5,149 youth (12-17 years old) with a history of justice involvement from 2009-2014 from National Survey on Drug Use and Health 97,976 youth (12-17 years old) without a history of justice involvement from 2009-2014 National Survey on Drug Use and Health	Cross- sectional/ Youth report of provider diagnosis	*STI *Asthma *High blood pressure *Diabetes	*Age *Gender *Race/ ethnicity	*Justice involved youth were more likely to report a physician diagnosed STI within the past year, and detention youth reported the highest risk *Probation (11.9%) and detention (14.1%) youth were more likely to report physician diagnosed asthma than non-adjudicated youth (9.9%) *Probation (1.7%) and detention (2.2%) youth were more likely to report physician diagnosed hypertension than non- adjudicated youth (1.1%) *Less than 1% across all groups had diabetes, and no differences existed between adjudicated and non-adjudicated youth

Reproductive Health

A total of 13 studies examined STI rates among adjudicated youth, and 2 studies examined pregnancy rates (see Table 1). Overall, studies indicate that youth in the juvenile justice system have high rates of STI, compared to youth in the general population. Whereas the prevalence of an STI among non-adjudicated youth ages 15-19 is less than 5% (CDC, 2016a), studies of adjudicated youth show rates as high as 14.6% (Dembo, Belenko, Child, & Wareham, 2009). Examinations of subgroups of adjudicated youth show even higher rates among girls, with up to 29.2% of justice-involved girls being diagnosed with an STI (Aalsma et al., 2011). Although studies examined a range of STIs, chlamydia and gonorrhea were the most common.

Chlamydia. Similar to youth in the general population (CDC, 2016a), studies examining STIs among justice-involved youth found rates of chlamydia to be among the most prevalent of STIs (Aalsma et al., 2011; Odgers, Robins, & Russell, 2010). According to the CDC (2016a), the rate of chlamydia in 2016 among non-adjudicated youth 15-19 years old was 1929.2 per 100,000 (or 1.9%). Of the 15 articles focusing on sexual and reproductive health, 11 reported chlamydia rates. The majority of these studies examined youth in detention (N = 9), with the remaining two studies focusing on youth on probation (Johnson et al., 2008) and newly arrested youth (Dembo et al., 2009). Studies indicate between 4.7% and 14.8% of adjudicated youth had been diagnosed with chlamydia. Several studies examined racial/ethnic, gender, and age differences in the percentage of youth who have chlamydia. Four of the five studies that examined racial/ethnic differences in chlamydia rates reported statistically significant differences. Three of these studies found African American youth to have higher rates than youth from other racial/ethnic groups (Aalsma et al., 2011; Burghardt, Chow, Steiner, & Bauer, 2016; Joesoef et al., 2009). One study, by Lofy, Hofmann, Mosure, Fine and Marrasso (2006), found chlamydia rates to be higher among Black, American Indian and Alaska Native, and Asian Pacific Islander youth than White youth. A study by Torrone et al. (2016) found no significant racial/ethnic differences in chlamydia rates.

All five studies examining gender differences found girls to have significantly higher chlamydia rates than boys (Aalsma et al., 2011; Dembo et al., 2009; Joesoef et al., 2009; Johnson et al., 2008). Findings regarding age differences in chlamydia rates were more varied. Of the four studies examining age differences, two studies found no statistically significant differences in chlamydia rates across age groups (Lofy et al., 2006; Voisin, Salazar, Crosby, & DiClemente, 2013). A study of detention girls (Torrone et al., 2016) found 15 – 18-year-old girls had significantly higher rates (11.1%) than 12 – 14-year-old girls (4.3%). Finally, Joesoef et al. (2009) found age differences in chlamydia rates among boys only, with boys ages 15-17 years (6.7%) having higher rates than boys ages 12-14 years (2.4%).

Gonorrhea. While gonorrhea rates among youth in the juvenile justice system were significantly lower than chlamydia rates, they were still high compared to youth in the general population. In 2016, the rate of gonorrhea among non-adjudicated youth 15-19 years old was 381.8 per 100,000 (or .38%) (CDC, 2016a). In the six studies reporting gonorrhea prevalence among adjudicated youth, percentages ranged between .6% to 4.3%. Only one study reported statistically significant gender differences for gonorrhea, finding higher rates among girls than boys (Aalsma et al., 2011). No studies examined age differences in gonorrhea rates, and the one study examining racial/ethnic differences found none (Aalsma et al., 2011).

Other Reproductive Health Problems. Although the majority of studies focused on chlamydia and gonorrhea, four studies reported rates of other STIs, including trichomonas and

HIV. An additional study by Winkelman et al. did not specify the type of STI investigated. Although two studies examined trichomonas among adjudicated youth (Aalsma et al. 2011; Odgers et al. 2010), only one reported data specifically for trichomonas in their results. Aalsma et al. (2011) found three percent of detention youth were diagnosed with trichomonas, with girls having much higher rates (11.2%) than boys (.8%). No racial/ethnic differences were found in trichomonas rates (Aalsma et al. 2011). One study by Barskey et al. (2016) examined HIV rates among youth in the juvenile justice system. They estimated 2.7% of youth 13-19 years old in correctional facilities were newly diagnosed with HIV between 2008 and 2011. A single study examined pelvic inflammatory disease (PID) among incarcerated girls (Odgers et al., 2010). Although not an STI, PID is an infection that often results from an untreated STI (e.g., chlamydia) and can cause pregnancy complications and infertility. The study by Odgers et al. (2010) found 7.3% of incarcerated girls had been diagnosed with PID. It is not clear whether this rate is higher or lower than youth from the general population, as the prevalence of PID among adolescents in the United States is unknown (Risser, Risser & Risser, 2017).

Pregnancy. Only two studies examined pregnancy rates among adjudicated girls. One study of detention girls found 6.1% of girls tested positive for pregnancy (Frye, Wallace, Chavez, & Luce, 2008). Another study by Kerr, Leve, and Chamberlain (2009) examining history of pregnancy among justice-involved youth in community-based care, found 25.3% of girls had been pregnant at some point in their lives. Both of these percentages are higher than girls in the general population, whose rates of pregnancy are reported at 2.9% (CDC, 2016a).

Injuries

Three studies examined traumatic brain injuries (TBI) among adjudicated youth (Gordon, Spielman, Hahn-Ketter, & Therese, 2017; Kaba, Diamond, Haque, MacDonald, & Venters, 2014; Vaughn, Salas-Wright, Delisi, & Perron, 2014), and one study examined non-TBI related injuries among justice-involved youth (Odgers et al., 2010). Lifetime prevalence rates of TBI ranged from 22% among youth in state correctional and county probation centers (Gordon et al., 2017) to 49.7% in a study of youth in a city jail system (Kaba et al., 2014). Although data on lifetime prevalence rates of TBI for youth in the general population are not available, these rates are much higher than the rates of less than 1% reported by the CDC (2016b) for TBI-related emergency department visits and hospitalizations for youth aged 5-14 years and 15-24 years. Gordon et al. (2017) and Kaba et al. (2014) examined causes for the injuries, finding assault and falls to be the most common circumstance of injury. Both studies found similar TBI rates resulting from assault (51.88% and 55.5%, respectively) and falls (42.5% and 41%, respectively) (Gordon et al., 2017; Kaba et al., 2014). Two studies reported age differences, with older youth slightly more likely to have had a TBI than younger youth (Gordon et al., 2017; Vaughn et al., 2014). While Vaughn et al.'s (2014) study of youth convicted of a serious criminal offense found statistically significant differences in age of TBI rates, there was only a slight difference in the average ages of those with and without TBI (16.15 years vs. 16 years). In a study comparing youth in state correctional facilities to youth in county probation centers, Gordon et al. (2017) found age differences in TBI only among youth at state correctional facilities, where older youth were reported as slightly more likely to have TBI than younger youth (age group averages were not provided).

Reports of gender differences in TBI were not consistent across studies. Whereas, Vaughn et al.'s (2014) study of youth convicted of a serious offense found boys were significantly more likely to have TBI than girls (gender group averages were not provided), Gordon et al.'s (2017)

study found higher TBI rates among girls (28.4%) than boys (21.3%) residing in state correctional facilities. Additionally, no gender differences in TBI were found among youth in county facilities (Gordon et al., 2017). Two studies reported racial/ethnic differences in TBI rates (Gordon et al., 2017; Vaughn et al., 2014). Among youth residing in state facilities, Gordon et al. (2017) found that non-Hispanic White youth were more likely to have TBI and African American youth were least likely to have TBI. Similarly, in Vaughn et al.'s (2014) study of youth convicted of a serious crime, non-Hispanic White youth were most likely to have TBI compared to youth from other racial/ethnic groups. However, among youth in county probation centers, Gordon et al. (2017) found that Hispanic youth were more likely to have TBI and African American youth were least likely to have TBI.

Only one study examined non-TBI injury rates among justice-involved youth. In a study of incarcerated girls, Odgers et al. (2010) found 60% reported physical injuries during adolescence. Seven injuries were examined, with fractures (32.8%) and self-injury (20.8%) as the most frequent injuries, and stab wounds (13.6%) and gunshot wounds (4.8%) as the least frequent (Odgers et al., 2010). These rates are much higher than rates of self-injury (.32%), stab wounds (.79%) and gunshot wounds (.04%) for youth ages 10-19 years in the general population (CDC, 2017a). Additional injuries reported by Odgers et al. (2010) include head injury (18.4%), unconsciousness (17.6%), and blunt trauma (14.5%), none of which were identified as TBI. Comparison data for fractures, head injury, unconsciousness and blunt trauma among youth in the general population are not available. No racial/ethnic differences in injury were reported.

Asthma

Two studies (Odgers et al., 2010; Winkelman, Frank, Binswanger, & Pinals, 2017) reported asthma prevalence among justice-involved youth. Both studies reported prevalence rates higher than the national average of 8.4% for youth under the age of 18 years (CDC, 2017b). In a study of incarcerated girls, Odgers et al. (2010) found 31.2% were diagnosed with asthma. A more recent study by Winkelman et al. (2017) comparing justice-involved youth to those with no justice involvement found higher percentages of asthma among adjudicated youth than their non-adjudicated peers. Whereas rates of asthma among youth with no justice involvement was 9.9%, asthma rates for adjudicated youth ranged from 11.9% for youth on probation to 14.1% for detained youth (Winkelman et al., 2017). No study examined racial/ethnic or gender differences in asthma rates.

Overweight, Obesity, Diabetes, and Hypertension

Three studies examined overweight and obesity among detained youth. In two studies (Keough et al., 2015; Odgers et al., 2010), rates of overweight and obesity were higher than the national average of 20.5% for youth between the ages of 12 and 19 years reported by DHHS (Ogden, Carroll, Fryar & Flegal, 2015). Odgers et al.'s (2010) study of girls found 57.4% of incarcerated girls to be either overweight or obese. Similarly, a study of detained youth by Keough et al. (2015) found an overall overweight/obesity rate of 40.8%, with 20.2% meeting criteria for overweight and 20.6% categorized as obese. No gender or racial/ethnic differences in overweight or obesity were found. Whereas the aforementioned studies found higher rates of overweight and obese youth than what is reported for the national average, a study by Feinstein, Gomez, Gordon, Cruise, and DePrato (2007) found an overall lower overweight rate of 8.2% for detained African American and non-Hispanic White youth. Further examination of subgroups of youth in this study reveal that this low rate was driven by rates for African American boys, which was significantly

low at 5.8% (Feinstein et al., 2007), compared to a national average of 18.4% for African American boys between the ages of 2-19 years reported by DHHS (Ogden et al., 2015). Overweight rates for detained African American girls (19.1%), non-Hispanic White girls (14.3%), and non-Hispanic White boys (10.6%) (Feinstein et al., 2007) were similar to the national average rates of 20.7%, 15.1%, and 14.3%, respectively (Ogden et al., 2015). Only the Feinstein et al. (2007) study examined gender differences, finding a higher percentage of African American girls categorized as overweight and obese than African American boys. Similar gender differences were not found among White youth (Feinstein et al., 2007).

A study examining diabetes among adjudicated youth found low rates in this population. Their comparison of adjudicated and non-adjudicated youth found adjusted prevalence rates of diabetes (Type unspecified) among adjudicated youth to be between .5% and .6% (Winkelman et al., 2017), which is higher than the .18% prevalence rate for youth under the age of 18 years in the United States (CDC, 2017). No differences in diabetes rates were found between adjudicated and non-adjudicated youth. The study did not examine gender or racial/ethnic differences in diabetes prevalence.

One study examined high blood pressure (hypertension) among justice-involved youth. Winkelman et al. (2017) found rates of less than 2.5% among youth across a range of justice involvement. Although the study found adjudicated youth's hypertension prevalence rate to be within the typical range of .3% - 4.5% for youth in the United States (Rao, 2016), Winkelman et al. (2017) found youth with a history of detainment, parole, or probation within the past year had significantly higher rates of high blood pressure than youth with no history of justice involvement (Winkelman et al., 2017). Hypertension rates by race/ethnicity or gender were not examined.

Mortality

Whereas several studies combined adolescent and adult mortality data, only two studies reported disaggregated mortality rates for adolescents in the juvenile justice system (Gallagher et al., 2006; Teplin et al., 2014). Both studies suggest adjudicated youth have higher death rates than their non-adjudicated peers. However, the degree of difference and the causes of death differed for each study. A 16-year longitudinal study following youth detained any time between 1995 and 1998 in Cook County, Illinois, found them to have a significantly higher mortality rate post-detainment than same aged peers from the general population of Cook County (Teplin et al., 2014). This finding held for both boys and girls, with the mortality rate among boys between the ages of 15-19 quintupling that of same-aged peers in the general population (Teplin et al., 2014). Racial/ethnic differences in mortality rates among boys were found, with African Americans having the highest mortality rate and non-Hispanic white having the lowest mortality rate. Among previously detained girls ages 15-19, mortality rates were nine times higher than same-aged girls in the general population (Teplin et al., 2014). The major cause of death for previously detained youth was homicide by firearm, which was responsible for 75% of deaths (Teplin et al., 2014). In a study examining youth under 21 years residing under the care of the juvenile justice system, Gallagher et al. (2006) found the mortality rate to be 7.8% higher than rates of youth in the general population, based on data calculated from the CDC, National Institute of Mental Health, and the U.S. Bureau of the Census (Gallagher et al., 2006). Unlike the Teplin et al. (2014) study of formerly detained youth, suicide was the major cause of death for adjudicated youth in residential care (Gallagher et al., 2006). Gallagher et al. (2006) found the suicide rate among adjudicated youth in residential care was three times higher than youth in the general population, and death

due to illness was 50% greater among adjudicated youth. However, adjudicated youth in residential facilities had lower rates of deaths due to homicide than their non-adjudicated peers (Gallagher et al., 2006).

Other Health Problems

One study examined oral health among detained youth. A study by Bolin and Jones (2006) found the majority of youth required some form of dental care, with 6.2% of youth having high treatment urgency, 13.1% moderate treatment urgency, and 80.7% low treatment urgency. Additionally, 86% of detained youth needed dental sealants, 74% had dental carries, and 42.2% needed professional plaque and supra-gingival calculus removal. Bolin and Jones (2006) also found detained youth had higher rates of decayed, missing, and filled teeth (DMFT) than youth in a national sample. For example, 49.6% of detention youth had untreated dental decay, compared to the national average of 20%. Comparisons to baseline data from Healthy People 2010 found a substantial difference in dental carries between detention youth and the national sample among Mexican-American youth (80% detention vs. 57% national sample), and only minimal differences among African-American (74% detention vs. 70% national sample) and White youth (61% detention vs. 60% national sample). No gender differences in oral health were found among detention youth, and statistical differences among detained youth by race/ethnicity were not reported (Bolin & Jones, 2006).

The final physical health problem found in studies published between January 2006 – July 2017 was lack of immunization. Only one study by Gaskin, Glanz, Binswager, & Anoshiravani (2015) examined immunization rates among adjudicated youth. They found only 3% of detained youth in California completed all recommended immunizations prior to first detention. With the exception of Hepatitis A and varicella-zoster virus (VZV) vaccines, immunization rates were significantly lower than rates for youth in the general population (Gaskin et al., 2015). Additionally, the study found immunization rates to increase with subsequent detention admissions. Youth with multiple detention episodes had coverage rates significantly higher than youth from the state's general population.

DISCUSSION

Over a period of 11 years, only 23 empirical studies were found that examined the prevalence of health problems, aside from issues of mental health and substance abuse, among adjudicated youth populations. Studies focused predominantly on detained youth, although youth in less restrictive settings were also examined (e.g., arrested, probation, and community-based alternatives to detention). Of the 23 studies, over half focused on sexual health. The remaining studies focused on a range of physical health problems, with injury (predominantly TBI), asthma, and overweight/obesity being the most prevalent. Whereas studies indicate rates of diabetes and high blood pressure among adjudicated youth to be within the range found among non-adjudicated adolescents, justice-involved youth were found to have higher rates of many other health issues.

Justice-involved youth have higher rates of pregnancy and STIs than youth in the general population. Similar to non-adjudicated populations, girls had higher STI rates than boys, African Americans had higher STI rates than youth from other ethnic/racial groups (with the exception of Lofy et al., 2006), and chlamydia was the most common STI. Additional research that focuses on prevention, screening, and treatment for reproductive health problems is needed among this population.

Studies have also found that justice-involved youth have higher rates of injuries than their non-adjudicated peers. Although the majority of research on injuries focused on TBI, studies of non-TBI related injuries indicate justice-involved youth have rates of self-injuries, stab wounds and gunshot wounds more than 10 times the national average (Odgers et al., 2010). Despite the increased interest in studies that examine the relationship between TBI and delinquent behavior (Williams, et al. 2018), only three studies in this review examined TBI rates among adjudicated youth specifically. However, all three studies found high rates among justice-involved youth, with one study reporting a nearly 50% prevalence rate among a sample of detained youth (Kaba, et al., 2014). Assaults and falls were the most common causes of TBI, and studies suggest TBI rate differences by age (older youth more likely) and race/ethnicity (White youth more likely). Research on gender differences in TBI rates were inconsistent. Although national data on TBI prevalence among the general adolescent population is limited to youth seeking treatment in hospitals, rates among these populations were less than 1% (CDC, 2016b), which is far lower than those reported for adjudicated youth. As we seek to clarify the role of brain injury in adjudicated youth's delinquent experiences, it is critical that researchers conduct more research on the prevalence and sequelae of TBI among adjudicated youth, as well as ways to prevent TBI among this population.

Justice-involved youth also have higher rates of asthma, and dental decay than their non-adjudicated peers. Two of the studies (Odgers et al., 2010; Winkelman, Frank, Binswanger, & Pinals, 2017) reported asthma rates more than twice as high as the national average of 9.8% for youth between the ages of 12-17 years (CDC, 2017). Regarding dental health, findings indicate rates of untreated dental decay among justice-involved youth to be twice as high as youth in a national sample (Bolin & Jones, 2006). Similarly, with the exception of one study, youth in the juvenile justice system were also found to have overweight or obesity rates at least twice as high than youth in the general population (Keough et al., 2015; Odgers et al., 2010). Although diabetes and hypertension, two diseases where overweight and obesity play a significant role, were not found at higher prevalence rates among adjudicated youth, it is possible that this is because the incidence for these diseases predominantly occur in adulthood and increase with age. Given the high prevalence of overweight/obesity among adjudicated youth, it would be important to determine longitudinally if prevalence rates of diabetes and hypertension become higher among these youth later in life in comparison to the general population.

A single study examined immunization rates among justice-involved youth. Consistent with anecdotal provider reports (American Academy of Pediatrics, 2011), rates of completed immunizations among youth in the juvenile justice system were extremely low at 3%. It is interesting to note that youth with multiple detentions had immunization rates significantly higher than non-adjudicated youth, suggesting detention may be a consistent source of health care for adjudicated youth and more accessible for them than care outside of the justice system.

Only two studies examined mortality rates among justice-involved youth. The dearth of mortality research is surprising, given this population's involvement in high risk and violent behaviors. The two studies in this review examined distinctly different youth populations; youth who had been detained and youth in residential care. Both groups of youth were found to have significantly higher rates of mortality than their non-adjudicated youth. However, reasons for death differed by population. Whereas, previously detained youth were more likely to die of homicidal firearm injuries, youth in residential care were more likely to die of suicide and illness. Studies

that continue to examine mortality rates and their causes for justice-involved youth are needed, so that focused interventions can be created for this population.

The findings from this review underscore the need for additional research that examines physical health problems among adjudicated youth. Many of the health conditions reviewed have the potential to lead to long-term illness and disability if not managed well in youth. Nevertheless, results should be interpreted within the context of study limitations. The research question is broad, focusing on any physical health problem, ranging from asthma to death, with the majority of studies focusing on sexual and reproductive health ($n = 13$). This breadth of coverage may prevent more detailed analysis of adjudicated youth's health challenges. While a more focused review would provide for nuanced information regarding specific health problems, the broad scope of this review is due to the paucity of research that exists on adjudicated youth's physical health.

Similarly, the study was equally broad in its focus on all adjudicated youth, from arrested youth to incarcerated youth, with the majority of studies focusing on detained youth in detention or correctional facilities. Only six of the 23 studies examined non-detained adjudicated youth. As a result, we know less about the physical health problems of youth who are arrested, on probation, or in community-based alternatives to detention. While many of their risk factors and associated health needs may be similar, it is likely that there may be differences between these subpopulations of adjudicated youth (e.g., immunization rates).

An additional limitation is that the review includes studies that utilized different methods for diagnosis. Whereas the majority of studies ($n = 14$) assessed youth's physical health problems via on-site screenings (either through clinical interviews or tests), some studies determined youth's status via review of medical charts. It is possible that the different types of assessments may yield different results, making comparisons across them difficult to interpret. Studies utilizing more consistent research methods for diagnosing health problems would provide a more accurate account of adjudicated youth's health challenges.

Despite these limitations, the review remains informative. To our knowledge, it is the only review of physical health problems among justice-involved youth. This paper provides an important first step towards understanding what is currently known about the health status of adjudicated youth. Whereas some studies showed higher rates of health challenges among adjudicated youth compared to their non-adjudicated peers (e.g., STIs, TBIs, asthma, and obesity), others showed no difference (e.g., diabetes, hypertension), which could be due to the cross-sectional nature of the studies. Additionally, with the exception of reproductive health, the status of many physical health conditions among adjudicated youth were examined and reported by fewer than four studies. These findings underscore the need for more studies examining physical health status and conditions, beyond sexual and reproductive health, among adjudicated youth. The review findings also point to a need for more data on physical health problems by subgroups of adjudicated youth (e.g., age, gender, race/ethnicity, type of adjudication) so that prevention efforts can be targeted accordingly. This is especially important for type of adjudication. Whereas the majority of the reviewed studies focused on youth in detention, non-detained adjudicated youth (i.e., court-involved, probation, community-based alternatives and combinations of adjudication) may have more undetected and unmet health needs (e.g., incomplete vaccinations), given they are not in a facility where they receive routine health care.

CONCLUSION

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Justice-involved youth are an understudied and vulnerable population. Given the high prevalence of some health conditions among youth in the juvenile justice system, it is essential that more research on physical health problems be dedicated to this population in order to determine whether disparities similar to those found for well-studied health problems (e.g., mental health, substance use, and sexual health) exist. Only through a greater understanding of these health risks and their long-term consequences will correctional institutions and health practitioners be able to provide effective prevention, intervention, and management techniques for this high-risk group. This information will also help to facilitate directions for community-based clinics that provide health services for adjudicated youth once released via referrals and follow-up care. More comprehensive reviews on the health status of justice-involved youth will help researchers identify what is currently known, and health areas in need of greater attention.

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