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Health Care, Family, and Community Factors Associated with Mental, Behavioral, and Developmental Disorders and Poverty Among Children Aged 2–8 Years — United States, 2016

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Childhood mental, behavioral, and developmental disorders (MBDDs) are associated with adverse outcomes that can persist into adulthood (*1*,*2*). Pediatric clinical settings are important for identifying and treating MBDDs (*3*). Early identification and treatment of MBDDs can promote healthy development for all children (*4*), especially those living in poverty who are at increased risk for MBDDs (*3*,*5*) but might have reduced access to care (*6*). CDC analyzed data from the 2016 National Survey of Children's Health (NSCH) on MBDDs, risk factors, and use of federal assistance programs (e.g., Supplemental Nutrition Assistance Program [SNAP]) to identify points to reach children in poverty. In line with previous research (*3*,*6*), compared with children in higher-income households, those in lower-income households more often had ever received a diagnosis of an MBDD (22.1% versus 13.9%), and less often had seen a health care provider in the previous year (80.4% versus 93.8%). Among children living below 200% of the federal poverty level (FPL) who did not see a health care provider in the previous year, seven of 10 were in families receiving at least one public assistance benefit. Public assistance programs might offer collaboration opportunities to provide families living in poverty with information, co-located screening programs or services, or connection to care.

NSCH is a national, cross-sectional, web-based and paper-based survey funded and directed by the Health Resources and Services Administration's Maternal and Child Health Bureau that is representative of noninstitutionalized children aged 0–17 years in the United States.* The U.S. Census Bureau conducted the 2016 NSCH using address-based sampling and created weights to account for oversampling and potential nonresponse biases.† Parents were asked, "Has a doctor or other health care provider ever told you that this child has (specified MBDDs)?" A child was considered to have ever had an MBDD if their parent reported one or more of the following: anxiety problems, depression, attention-deficit/hyperactivity disorder, behavioral or conduct problems, Tourette syndrome, autism spectrum disorder, learning disability, intellectual disability, developmental delay, or language problems. Parents also responded to questions related to factors associated with

* https://mchb.hrsa.gov/data/national-surveys/data-user.

† https://census.gov/content/dam/Census/programs-surveys/nsch/tech-documentation/nonresponse-bias-analysis/NSCH%202016%20Nonresponse%20Bias%20Analysis.pdf.

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MBDDs (*1*,*3*), including household income, health insurance, components of a medical home, difficulty getting by on the family's income, parent emotional support, neighborhood condition (e.g., litter or vandalism), neighborhood amenities (e.g., sidewalks or parks), and parental mental or physical health, as well as whether they received public assistance (e.g., SNAP; Women, Infants, and Children [WIC]; free or reduced price meals at school; or cash assistance).[§]

Parents of 50,212 children participated in the survey, resulting in an interview completion rate of 69.7% and a weighted response rate of 40.7%. Analyses were restricted to children aged 2–8 years with nonmissing data on MBDD diagnosis and age (16,912 children). Data missing on race (0.3%), ethnicity (0.5%), sex (0.1%), and FPL (16.6%) were imputed using hot-deck imputation (a method for handling missing data in which missing values are replaced with observed responses from "similar" units) and regression methods.[¶] Differences in demographic, health care, family, and community factors by MBDD status were assessed using weighted prevalence estimates, prevalence ratios (PRs), 95% confidence intervals (CIs), and Wald chi-square tests. Prevalence of MBDDs, health care, family, and community factors were compared by FPL category. Weighted prevalence estimates, PRs, and 95% CIs were calculated. To further explore whether federal assistance programs are possible points to reach children living in poverty, 4,410 children living below 200% of the FPL who had and had not seen a health care provider in the past year, both with and without MBDDs, were compared by whether their families received public assistance. Statistical software was used to account for the complex survey design.

Overall, 17.4% of children aged 2–8 years had at least one MBDD (Table 1). Child sex, age, and race/ethnicity varied by MBDD status. Compared with children without MBDDs, those with MBDDs more often lived in the lowest income category (<100% of FPL; PR = 1.4) and less often in the highest category (≥400% of FPL; PR = 0.8). Prevalences of most risk factors (e.g., child care problems, and lack of support in neighborhood) were higher among children with MBDDs than among those without MBDDs.

Prevalence of MBDDs was higher in each consecutive decreasing income level compared with the highest level (≥400% of FPL) (Table 2); estimates of MBDDs ranged from 13.9% among those in the highest income level (≥400% of FPL) to 22.1% among those in the lowest level (<100% of FPL). A lower percentage of children in lower-income households saw a health care provider in the past 12 months (80.4%) and a higher percentage did not receive needed care (5%), compared with children in the highest income level (93.8% and 0.8%, respectively). Similar patterns across income levels were found for most health care, family, and community factors (e.g., increasing prevalences of the risk factors as household

[§] https://www.census.gov/programs-surveys/nsch/technical-documentation/codebooks.html.

[¶] https://census.gov/content/dam/Census/programs-surveys/nsch/tech-documentation/methodology/2016-NSCH-Methodology-Report.pdf.

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TABLE 1. Prevalence of demographic, health care, family, and community factors, by ever having any mental, behavioral, or developmental disorder (MBDD)* among children aged 2–8 years — National Survey of Children's Health, United States, 2016

Characteristic	Any MBDD % (95% CI)†	No MBDD % (95% CI)†	Any MBDD/No MBDD prevalence ratio (95% CI)	p-value§
Overall	**17.4 (16.2–18.7)**	**82.6 (81.3–83.8)**	—	—
Child sex				
Male¶	66.7 (63.0–70.1)	47.8 (46.0–49.6)	1.4 (1.3–1.5)	<0.001§
Child age group (yrs)				
2–3	18.0 (15.1–21.3)	30.4 (28.9–32.0)	0.6 (0.5–0.7)	<0.001§
4–5	25.0 (21.7–28.5)	29.2 (27.6–30.9)	0.9 (0.7–1.0)	0.028§
6–8	57.0 (53.1–60.8)	40.4 (38.5–42.2)	1.4 (1.3–1.5)	<0.001§
Child race/ethnicity**				
White, non-Hispanic	53.6 (49.6–57.5)	51.7 (49.9–53.6)	1.0 (1.0–1.1)	0.405
Black, non-Hispanic	13.8 (11.2–16.9)	11.5 (10.3–12.8)	1.2 (1.0–1.5)	0.137
Hispanic	24.2 (20.1–28.7)	24.4 (22.4–26.5)	1.0 (0.8–1.2)	0.940
Other, non-Hispanic	8.4 (7.1–10.0)	12.4 (11.5–13.5)	0.7 (0.6–0.8)	<0.001§
Parent education				
Less than high school	8.7 (6.0–12.4)	7.7 (6.2–9.5)	1.1 (0.7–1.7)	0.577
High school	19.9 (16.7–23.6)	17.2 (15.6–18.8)	1.2 (1.0–1.4)	0.154
More than high school	71.4 (67.1–75.3)	75.2 (73.1–77.1)	0.9 (0.9–1.0)	0.107
Language				
Primary language other than English	11.0 (7.8–15.4)	15.5 (13.7–17.4)	0.7 (0.5–1.0)	0.035§
Urban/Rural designations††				
Urban	89.6 (87.6–91.3)	91.1 (90.4–91.8)	1.0 (1.0–1.0)	0.136
Large rural	6.2 (4.8–8.0)	5.1 (4.6–5.7)	1.2 (0.9–1.6)	0.198
Small rural	2.6 (1.9–3.5)	2.2 (1.9–2.5)	1.2 (0.9–1.7)	0.302
Isolated	1.6 (1.1–2.4)	1.6 (1.3–2.0)	1.0 (0.6–1.5)	0.960
Federal poverty level§§				
≥400%	22.9 (19.8–26.3)	29.8 (28.2–31.5)	0.8 (0.7–0.9)	0.001§
200%–399%	27.0 (22.8–31.7)	28.7 (27.0–30.4)	0.9 (0.8–1.1)	0.488
100%–199%	24.2 (20.4–28.4)	22.3 (20.5–24.2)	1.1 (0.9–1.3)	0.409
<100%	25.9 (22.1–30.0)	19.2 (17.4–21.1)	1.4 (1.1–1.6)	0.002§
Health care				
Inadequate or no insurance¶¶	33.8 (30.2–37.7)	25.4 (23.9–27.1)	1.3 (1.2–1.5)	<0.001§
Public insurance***	51.1 (47.2–54.9)	34.4 (32.5–36.3)	1.5 (1.4–1.6)	<0.001§
Lacks a medical home†††	58.1 (54.3–61.8)	48.2 (46.3–50.0)	1.2 (1.1–1.3)	<0.001§
Child saw health care provider in past year§§§	90.0 (86.3–92.7)	87.6 (86.1–88.9)	1.0 (1.0–1.1)	0.174
Needed care not received¶¶¶	7.0 (5.1–9.4)	1.7 (1.1–2.5)	4.2 (2.5–6.9)	<0.001§
Family				
Fair or poor parental mental health****	13.7 (10.9–17.1)	5.7 (4.9–6.7)	2.4 (1.8–3.2)	<0.001§
Fair or poor parental physical health††††	15.7 (12.8–19.2)	8.1 (7.0–9.2)	2.0 (1.5–2.5)	<0.001§
Difficult to get by on family's income§§§§	38.0 (34.2–42.0)	21.3 (19.7–22.9)	1.8 (1.6–2.0)	<0.001§
Parent lacks emotional support¶¶¶¶	21.2 (17.9–24.9)	23.3 (21.4–25.3)	0.9 (0.8–1.1)	0.299
Child care problems (ages 0–5 only)*****	18.8 (13.8–25.2)	5.3 (4.4–6.3)	3.5 (2.5–5.0)	<0.001§
Community				
Neighborhood without amenities†††††	65.2 (61.3–68.9)	60.3 (58.5–62.0)	1.1 (1.0–1.2)	0.023§
Neighborhood in poor condition§§§§§	26.8 (23.4–30.6)	24.5 (22.8–26.2)	1.1 (0.9–1.3)	0.245
Lack of support in neighborhood¶¶¶¶¶	35.7 (31.7–39.9)	26.5 (24.7–28.4)	1.3 (1.2–1.5)	<0.001§
Neighborhood perceived to lack safety******	6.8 (4.8–9.5)	5.4 (4.4–6.6)	1.3 (0.8–1.9)	0.300

See table footnotes on the next page.

income level decreased), with the exception that inadequate insurance was less often reported for children in the lower income levels than for those in the highest level.

Among children living at <200% of FPL, 82.6% saw a health care provider in the past year, and 73.4% received public assistance (Table 3). Among the children who did not see a health care provider in the past year, 69.0% received public assistance and 19.2% had a diagnosed MBDD. Among children who did not see a health care provider in the past year and had a diagnosed MBDD, 81.7% received public assistance. Of children who did not see a health care provider in the past year and did not have a diagnosed MBDD, 66.0% received public assistance.

Discussion

Consistent with previous studies (*3*,*5*,*7*), this study found that children living in lower-income households had higher prevalences of a parent-reported diagnosis of an MBDD and

TABLE 1. (*Continued*) Prevalence of demographic, health care, family, and community factors, by ever having any mental, behavioral, or developmental disorder (MBDD)* among children aged 2–8 years — National Survey of Children's Health, United States, 2016

Abbreviation: CI = confidence interval.

* Based on a response of "yes" to whether "a doctor or other health care provider ever told you that this child has" one or more of the following disorders: "anxiety problems, depression, attention-deficit/hyperactivity disorder, behavioral or conduct problems, Tourette syndrome, autism spectrum disorder, learning disability, intellectual disability, developmental delay, or speech or other language disorder."

† Percentages are weighted. Column percentages might not sum to 100% because of rounding.

§ p-value for weighted Wald chi-square test. All p-values <0.05 indicate statistically significant differences from "No MBDD."

¶ Missing data on sex were imputed for 0.1% of the sample using hot-deck imputation methods.

** Missing data on race and ethnicity were imputed for 0.3% and 0.5% of the sample, respectively, using hot-deck imputation methods. "Other, non-Hispanic" includes American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and Asian.

†† Urban and rural designations were determined using a four-category classification based on 2010 rural-urban community area codes (RUCAs), a census tract–based classification system. Urban areas (RUCA codes 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, and 10.1) include metropolitan areas and surrounding towns from which commuters flow to an urban area; large rural areas (RUCA codes 4.0, 5.0, and 6.0) include large towns (micropolitan areas) with populations of 10,000–49,999 and their surrounding areas; small rural areas (RUCA codes 7.0, 7.2, 8.0, 8.2, and 9.0) include small towns with populations of 2,550–9,999 and up to 50% secondary flow to a large urban cluster of up to 50,000; and isolated areas (RUCA codes 10.0, 10.2, and 10.3) with less than 2,500 population and up to 50% secondary flow to a large or small urban cluster (population up to 10,000). (https://www.census.gov/geo/reference/ua/urban-rural-2010.html).

§§ Federal poverty level is based on family income and family size and composition using federal poverty thresholds that are updated annually by the U.S. Census Bureau using the change in the average annual consumer price index for all urban consumers. Imputed income was used for 16.6% of children aged 2–8 years with MBDD status and sex reported, but without reported household income, using regression methods.

¶¶ Based on a negative value for any of four variables based on these questions: 1) "Is this child currently covered by any kind of health insurance or health coverage plan?" 2) "How often does this child's health insurance offer benefits or cover services that meet this child's needs?" 3) "Does the family pay out-of-pocket expenses," and if yes, "How often are these costs reasonable?" and 4) "How often does this child's health insurance allow him or her to see the health care providers he or she needs?"

*** Based on a response of "yes" to having "Medicaid, Medical Assistance, or any kind of government assistance plan for those with low incomes or a disability."

††† Based on five component variables (personal doctor or nurse, usual source for sick and well care, family-centered care, problems getting needed referrals, satisfaction with communication, and effective care coordination when needed), derived from 16 survey items. To have a medical home, the child must have a personal doctor or nurse, usual source of care, and family-centered care; children needing referrals or care coordination must also have those criteria met.

§§§ Whether the child saw a health care provider in the last 12 months was based on a response of "yes" to the following question: "During the past 12 months, did this child see a doctor, nurse, or other health care professional for sick-child care, well-child check-ups, physical exams, hospitalizations, or any other kind of medical care?"

¶¶¶ Based on a response of "yes" to the following question: "During the past 12 months, was there any time when this child needed health care, but it was not received? By health care, we mean medical care as well as other kinds of care like dental care, vision care, and mental health services."

**** Based on whether either parent reported "fair" or "poor" (i.e., compared with "excellent," "very good," or "good") to the question "In general, how is your mental or emotional health?"

†††† Based on whether either parent reported "fair" or "poor" (i.e., compared with "excellent," "very good," or "good") to the question: "In general, how is your physical health?"

§§§§ Based on an answer of "very often" or "somewhat often" (i.e., compared with "never" or "rarely") to the question: "Since this child was born, how often has it been very hard to get by on your family's income (e.g., hard to cover the basics like food or housing)?"

¶¶¶¶ Based on a response of "no" to the question "During the past 12 months, was there someone that you could turn to for day-to-day emotional support with parenting or raising children?"

***** Based on a response of "yes" to the question: "During the past 12 months, did you or anyone in the family have to quit a job, not take a job, or greatly change your job because of problems with child care for (child)?". Note: This question was asked for children aged 0-5 years only.

††††† Based on a response of "no" to any of the following four questions: "In your neighborhood, is/are there: 1) sidewalks or walking paths?; 2) a park or playground?; 3) a recreation center, community center, or boys' and girls' club?; 4) a library or bookmobile?"

§§§§§ Based on a response of "yes" to any of the following three questions: "In your neighborhood, is/are there: 1) litter or garbage on the street or sidewalk?; 2) poorly kept or rundown housing?; 3) vandalism such as broken windows or graffiti?"

¶¶¶¶¶ Based on a response of "definitely disagree" or "somewhat disagree" (i.e., compared with "definitely agree" or "somewhat agree") to any of the following three questions: "To what extent do you agree with these statements about your neighborhood or community? 1) People in this neighborhood help each other out; 2) We watch out for each other's children in this neighborhood; 3) When we encounter difficulties, we know where to go for help in our community."

****** Based on a response of "definitely disagree" or "somewhat disagree" (i.e., compared with "definitely agree" or "somewhat agree") to the following statement: "This child is safe in our neighborhood."

other health care, family, and community risk factors associated with MBDDs than did children living in higher-income households. Most children had seen a health care provider in the past year regardless of income level; therefore, the American Academy of Pediatrics recommendation to screen for MBDDs (*8*) and family and socioeconomic risk factors (*4*) during primary care visits appears to be theoretically feasible.

Screening**,†† in health care settings can be challenging in practice, and MBDDs might be underdiagnosed even among children who have recently seen a health care provider (*9*). Children living in lower-income households had lower prevalences of having seen a health care provider in the past year and of receiving needed health care compared with children living in higher-income households. Approximately one in five children living at <200% of FPL who did not see a health care provider in the past year had a diagnosed MBDD. This, coupled with families with lower incomes reporting greater difficulty receiving needed health care, raises concern that MBDDs might be undertreated in this population. Additionally, families living in poverty were more likely to experience a range of risk factors related to MBDDs; therefore, connections to health care services are especially relevant for this population.

** https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Screening/Pages/default.aspx.

†† https://eclkc.ohs.acf.hhs.gov/publication/birth-5-watch-me-thrive-compendium-screening-measures-young-children.

TABLE 2. Prevalence of parental report of any mental, behavioral, or developmental disorder (MBDD), and health care, family, and community factors among children aged 2–8 years, by federal poverty level — National Survey of Children's Health, United States, 2016

	Percentage of federal poverty level*							
	≥400% (referent)	200%–399%		100%–199%		<100%		Overall
Characteristic	% (95% CI)†	% (95% CI)†	PR (95% CI)	% (95% CI)†	PR (95% CI)	% (95% CI)†	PR (95% CI)	% (95% CI)†
MBDD§	13.9 (12.1–16.0)	16.6 (14.1–19.3)	1.2 (0.9–1.5)	18.6 (15.5–22.1)	1.3 (1.1–1.7)¶	22.1 (18.8–25.9)	1.6 (1.3–2.0)¶	17.4 (16.2–18.7)
Health care								
Inadequate or no insurance**	27.4 (25.2–29.7)	33.0 (30.2–36.0)	1.2 (1.1–1.4)¶	24.1 (20.5–28.0)	0.9 (0.7–1.0)	20.7 (16.9–25.2)	0.8 (0.6–0.9)¶	26.9 (25.5–28.4)
Public insurance††	6.6 (4.7–9.2)	21.8 (19.0–24.8)	3.3 (2.2–5.0)¶	61.6 (57.6–65.4)	9.4 (6.7–13.2)¶	76.3 (71.6–80.5)	11.7 (8.2–16.6)¶	37.3 (35.5–39.0)
Lacks a medical home§§	36.7 (34.4–39.0)	48.2 (45.2–51.3)	1.3 (1.2–1.4)¶	57.7 (53.7–61.7)	1.6 (1.4–1.7)¶	62.1 (57.7–66.4)	1.7 (1.5–1.9)¶	49.9 (48.2–51.5)
Child saw health care provider in past year¶¶	93.8 (92.4–95.0)	90.1 (88.0–91.8)	1.0 (0.9–1.0)¶	84.7 (80.8–88.0)	0.9 (0.9–0.9)¶	80.4 (75.6–84.5)	0.9 (0.8–0.9)¶	88.0 (86.6–89.2)
Needed care not received***	0.8 (0.5–1.2)	1.9 (1.3–2.7)	2.4 (1.4–4.4)¶	3.6 (2.3–5.6)	4.6 (2.4–9.1)¶,†††	5.0 (3.0–8.2)	6.4 (3.2–12.6)¶,†††	2.6 (2.0–3.3)
Family								
Fair or poor parental mental health§§§	3.9 (2.8–5.5)	6.1 (4.3–8.6)	1.6 (1.0–2.6)	10.5 (7.9–13.7)	2.7 (1.7–4.2)¶	15.4 (12.2–19.1)	3.9 (2.6–5.8)¶	8.0 (7.0–9.1)
Fair or poor parental physical health¶¶¶	3.4 (2.4–4.7)	8.5 (6.5–11.1)	2.6 (1.7–3.9)¶	14.6 (11.5–18.4)	4.4 (2.9–6.7)¶	21.9 (18.1–26.2)	6.6 (4.5–9.6)¶	10.6 (9.4–11.8)
Difficult to get by on family's income****	6.1 (4.8–7.7)	19.9 (17.3–22.8)	3.3 (2.4–4.5)¶	34.6 (30.7–38.8)	5.7 (4.3–7.5)¶	45.0 (40.2–50.0)	7.4 (5.8–9.4)¶	24.2 (22.7–25.7)
Parent lacks emotional support††††	13.0 (11.1–15.0)	18.2 (15.5–21.2)	1.4 (1.1–1.8)¶	29.2 (24.9–34.0)	2.3 (1.8–2.8)¶	36.9 (32.0–42.1)	2.9 (2.3–3.5)¶	22.9 (21.2–24.7)
Child care problems (ages 0–5 yrs only)§§§§	3.4 (2.4–4.6)	8.0 (5.7–10.9)	2.4 (1.5–3.7)¶	7.8 (5.4–11.1)	2.3 (1.4–3.8)¶	10.7 (7.9–14.4)	3.2 (2.0–5.0)¶	7.1 (6.0–8.3)
Community								
Neighborhood without amenities¶¶¶¶	51.3 (49.0–53.6)	61.6 (58.7–64.3)	1.2 (1.1–1.3)¶	65.6 (61.0–69.9)	1.3 (1.2–1.4)¶	70.1 (65.1–74.7)	1.4 (1.3–1.5)¶	61.1 (59.5–62.7)
Neighborhood in poor condition*****	15.0 (13.3–16.9)	23.2 (20.5–26.0)	1.5 (1.3–1.8)¶	28.4 (24.5–32.7)	1.9 (1.6–2.3)¶	38.1 (33.4–42.9)	2.5 (2.1–3.0)¶	24.9 (23.4–26.4)
Lack of support in neighborhood†††††	15.5 (13.6–17.5)	25.7 (22.4–29.2)	1.7 (1.4–2.0)¶	35.0 (30.7–39.6)	2.3 (1.9–2.7)¶	41.8 (37.0–46.8)	2.7 (2.3–3.2)¶	28.0 (26.4–29.7)
Neighborhood perceived to lack safety§§§§§	1.5 (0.9–2.6)	4.6 (3.4–6.3)	3.0 (1.8–5.2)¶	6.7 (4.6–9.8)	4.4 (2.4–8.2)¶,†††	11.9 (8.6–16.4)	7.9 (4.4–14.2)¶	5.6 (4.7–6.7)
Urban/Rural status¶¶¶¶¶								
Urban	94.6 (93.8–95.3)	90.2 (89.1–91.2)	1.0 (0.9–1.0)¶	89.4 (87.8–90.9)	0.9 (0.9–1.0)¶	87.9 (85.5–90.0)	0.9 (0.9–1.0)¶	90.8 (90.1–91.5)
Large rural	3.4 (2.8–4.1)	5.6 (4.9–6.4)	1.6 (1.3–2.1)¶	6.1 (5.0–7.5)	1.8 (1.4–2.4)¶	6.6 (5.1–8.5)	1.9 (1.4–2.7)¶	5.3 (4.8–5.8)
Small rural	1.3 (1.0–1.7)	2.3 (1.8–2.8)	1.7 (1.2–2.5)¶	2.3 (1.8–3.0)	1.8 (1.2–2.6)¶	3.4 (2.5–4.6)	2.6 (1.7–3.9)¶	2.2 (2.0–2.6)
Isolated	0.6 (0.5–0.9)	2.0 (1.5–2.5)	3.0 (2.1–4.5)¶	2.1 (1.5–2.8)	3.2 (2.1–5.0)¶	2.1 (1.3–3.3)	3.2 (1.9–5.7)¶	1.6 (1.4–1.9)

Abbreviations: CI = confidence interval; PR = prevalence ratio.

* Federal poverty level is based on family income and family size and composition using federal poverty thresholds that are updated annually by the U.S. Census Bureau using the change in the average annual consumer price index for all urban consumers. Imputed income was used for 16.6% of children aged 2–8 years with MBDD status and sex reported, but without reported household income, using regression methods.

† Percentages are weighted. Column percentages might not sum to 100% because of rounding.

§ Based on a response of "yes" to whether "a doctor or other health care provider ever told you that this child has" one or more of the following disorders: "anxiety problems, depression, attention-deficit/hyperactivity disorder, behavioral or conduct problems, Tourette syndrome, autism spectrum disorder, learning disability, intellectual disability, developmental delay, or speech or other language disorder."

¶ Statistically significant difference from the referent group.

** Based on a negative value for any of four variables based on these questions: 1) "Is this child currently covered by any kind of health insurance or health coverage plan?" 2) "How often does this child's health insurance offer benefits or cover services that meet this child's needs?" 3) "Does the family pays out-of-pocket expenses," and if yes, "How often are these costs reasonable?" and 4) "How often does this child's health insurance allow him or her to see the health care providers he or she needs?"

†† Based on a response of "yes" to having "Medicaid, Medical Assistance, or any kind of government assistance plan for those with low incomes or a disability."

§§ Based on five component variables (personal doctor or nurse, usual source for sick and well care, family-centered care, problems getting needed referrals, satisfaction with communication, and effective care coordination when needed), derived from 16 survey items. To have a medical home, the child must have a personal doctor or nurse, usual source of care, and family-centered care; children needing referrals or care coordination must also have those criteria met.

¶¶ Based on a response of "yes" to the following question: "During the past 12 months, did this child see a doctor, nurse, or other health care professional for sick-child care, well-child check-ups, physical exams, hospitalizations or any other kind of medical care?"

*** Based on a response of "yes" to the following question: "During the past 12 months, was there any time when this child needed health care but it was not received? By health care, we mean medical care as well as other kinds of care like dental care, vision care, and mental health services."

††† Estimate has a relative standard error >30% and might be unreliable.

§§§ Based on whether either parent reported "fair" or "poor" (i.e., compared with "excellent," "very good," or "good") to the question: "In general, how is your mental or emotional health?"

¶¶¶ Based on whether either parent reported "fair" or "poor" (i.e., compared with "excellent," "very good," or "good") to the question "In general, how is your physical health?"

**** Based on an answer of "very often" or "somewhat often" (i.e., compared with "never" or "rarely") to the question "Since this child was born, how often has it been very hard to get by on your family's income (hard to cover the basics like food or housing)?"

†††† Based on a response of "yes" to the question "During the past 12 months, was there someone that you could turn to for day-to-day emotional support with parenting or raising children?"

§§§§ Based on a response of "yes" to the question: "During the past 12 months, did you or anyone in the family have to quit a job, not take a job, or greatly change your job because of problems with child care for (child)? Note: This question was asked for children aged 0–5 years only.

¶¶¶¶ Based on a response of "no" to any of the following four questions: "In your neighborhood, is/are there: 1) sidewalks or walking paths? 2) a park or playground? 3) a recreation center, community center, or boys' and girls' club? 4) a library or bookmobile?"

***** Based on a response of "yes" to any of the following three questions: "In your neighborhood, is/are there: 1) Litter or garbage on the street or sidewalk? 2) Poorly kept or rundown housing? 3) Vandalism such as broken windows or graffiti?"

††††† Based on a response of "definitely disagree" or "somewhat disagree" (i.e., compared with "definitely agree" or "somewhat agree") to any of the following three questions: "To what extent do you agree with these statements about your neighborhood or community? 1) People in this neighborhood help each other out, 2) We watch out for each other's children in this neighborhood, 3) When we encounter difficulties, we know where to go for help in our community."

§§§§§ Based on a response of "definitely disagree" or "somewhat disagree" (i.e., compared with "definitely agree" or "somewhat agree") to the following question: "To what extent do you agree with these statements about your neighborhood or community? 1) This child is safe in our neighborhood."

¶¶¶¶¶ Urban and rural designations were determined using a four-category classification based on 2010 rural-urban community area codes (RUCAs), a census tract–based classification system. Urban areas (RUCA codes 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, and 10.1) include metropolitan areas and surrounding towns from which commuters flow to an urban area; large rural areas (RUCA codes 4.0, 5.0, and 6.0) include large towns (micropolitan areas) with populations of 10,000–49,999 and their surrounding areas; small rural areas (RUCA codes 7.0, 7.2, 8.0, 8.2, and 9.0) include small towns with populations of 2,550–9,999 and up to 50% secondary flow to a large urban cluster of up to 50,000; isolated areas (RUCA codes 10.0, 10.2, and 10.3) with less than 2,500 population and up to 50% secondary flow to a large or small urban cluster (population up to 10,000). (https://www.census.gov/geo/reference/ua/urban-rural-2010.html).

TABLE 3. Service use among children* living below 200% of the federal poverty level, by parental report of any mental, behavioral, and developmental disorder (MBDD) — National Survey of Children's Health, United States, 2016

Characteristic	No public assistance† % (95% CI)§	Public assistance† % (95% CI)§	Total % (95% CI)§
Child saw health care provider in the past year¶	25.7 (23.1–28.4)	74.3 (71.6–76.9)	**82.6 (79.7–85.2)**
With MBDD**	15.1 (11.6–19.6)	84.9 (80.4–88.4)	**21.1 (18.5–24.0)**
Without MBDD**	28.5 (25.5–31.7)	71.5 (68.3–74.5)	**78.9 (76.0–81.5)**
Child did not see health care provider in the past year¶	31.1 (24.2–38.7)	69.0 (61.3–75.8)	**17.4 (14.8–20.3)**
With MBDD**	18.3†† (9.1–33.3)	81.7 (66.7–90.9)	**19.2 (13.0–27.5)**
Without MBDD**	34.0 (26.1–42.9)	66.0 (57.1–73.9)	**80.8 (72.5–87.0)**
Total	**26.6 (24.1–29.2)**	**73.4 (70.8–75.9)**	—

Abbreviation: CI = confidence interval.

* Restricted to nonmissing responses for child MBDD status, whether the child's family received public assistance, and whether the child saw a health care provider in the past year.

† Based on whether the parent reported the family received any of the four benefits (cash assistance; Women, Infants, and Children; Supplemental Nutrition Assistance Program; or free or reduced cost meals at school) at any time during the past 12 months.

§ Percentages are weighted. Column and row percentages might not sum to 100% because of rounding.

¶ Based on response to the following question: "During the past 12 months, did (child) see a doctor, nurse, or other health care professional for sick-child care, well-child check-ups, physical exams, hospitalizations, or any other kind of medical care?"

** Based on response to whether "a doctor or other health care provider ever told you that this child has" one or more of the following disorders: "anxiety problems, depression, attention-deficit/hyperactivity disorder, behavioral or conduct problems, Tourette syndrome, autism spectrum disorder, learning disability, intellectual disability, developmental delay, or speech or other language disorder."

†† Estimate is unstable; relative standard error = 33.3%.

Public assistance programs might provide opportunities to connect families living in poverty to services, in line with the American Academy of Pediatrics call for collaboration between public health professionals and pediatricians (*10*). Where treatment resources are available, education or early identification programs could be embedded within services families are already accessing. For example, CDC's Learn the Signs. Act Early program connects WIC staff members with resources for parents about early identification of developmental delays and helps staff with referrals to primary care.§§ Similar approaches to promoting parental awareness of MBDDs and the value of pediatric screening, if carefully designed to minimize stigmatization, could be implemented within other public assistance programs. Identification of MBDDs and associated risk factors (e.g., poor parental mental health or lack of support) and connection to services can be challenging for families, even among those with primary care. Therefore, expanded co-location of developmental and behavioral health services in public assistance programs, as well as other sites that would reach additional families (e.g., schools or early-learning settings, federally qualified health centers,¶¶ or federal partnerships***), might help to eliminate barriers to care for families living in poverty.†††, §§§

§§ https://www.cdc.gov/ncbddd/actearly/wic-providers.html.

¶¶ https://www.hrsa.gov/opa/eligibility-and-registration/health-centers/fqhc/index.html.

*** https://healthysafechildren.org/grantee/project-launch.

††† https://www.milbank.org/publications/behavioral-health-integration-in-pediatric-primary-care-considerations-and-opportunities-for-policymakers-planners-and-providers/.

§§§ https://www2.ed.gov/about/inits/ed/earlylearning/files/health-early-learning-statement.pdf.

Summary

What is already known about this topic?

Poverty, as well as health care, family, and community factors are associated with mental, behavioral, and developmental disorders (MBDDs) in children.

What is added by this report?

Parent-reported data from 2016 showed that a higher percentage of children in lower-income households had ever received a diagnosis of an MBDD and a lower percentage had seen a health care provider in the previous year, compared with children in higher-income households. Most children in lower-income households were in families receiving public assistance benefits.

What are the implications for public health practice?

Public assistance programs might offer collaboration opportunities for public health and pediatrics to provide information, implement co-located screening programs or services, or facilitate connection to care.

The findings in this report are subject to at least three limitations. First, data are cross-sectional, so it was not possible to ascertain temporal associations or causality. Second, the sampling weights used to calculate nationally representative estimates might not completely compensate for nonresponse bias. Finally, indicators rely on parental report and might be subject to recall or social desirability bias.

Early identification and treatment of MBDDs could positively impact a child's functioning and reduce the need for costly interventions over time (*8*). Public assistance programs hold potential for increasing developmental monitoring and connection to treatment for MBDDs for families living in

poverty by collaborating to distribute resources, implementing co-located screening services, or facilitating connections to appropriate treatment and care.

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Drug, Opioid-Involved, and Heroin-Involved Overdose Deaths Among American Indians and Alaska Natives — Washington, 1999–2015

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The opioid epidemic has resulted in a threefold increase in drug overdose deaths in the United States during 1999–2015 (*1*). Whereas American Indians/Alaska Natives (AI/AN) have experienced larger increases in drug overdose mortality than have other racial/ethnic groups in the United States (*2*), little is known about the regional impact of opioids in tribal and urban AI/AN communities. To address this data gap, death records from the Washington State Center for Health Statistics, corrected for misclassification of AI/AN race, were examined to identify trends and disparities in drug, opioid-involved, and heroin-involved overdose mortality rates for AI/AN and non-Hispanic whites (whites) in Washington. Although AI/AN and whites had similar overdose mortality rates during 1999–2001, subsequent overdose rates among AI/AN increased at a faster rate than did those among whites. During 2013–2015, mortality rates among AI/AN were 2.7 and 4.1 times higher than rates among whites for total drug and opioid-involved overdoses and heroin-involved overdoses, respectively. Washington death certificates that were not corrected for misclassification of AI/AN race underestimated drug overdose mortality rates among AI/AN by approximately 40%. National statistics on the opioid epidemic, which report that overdose mortality rates are significantly higher among whites than among AI/AN, are not reflective of regional prevalences, disparities, and trends. Comprehensive efforts to address the opioid epidemic in AI/AN communities rely on strong partnerships between tribal governments and local, state, and federal entities. Additional measures are needed for community-based surveillance, treatment, and prevention to effectively respond to the epidemic across diverse tribal and urban AI/AN communities.

Washington drug overdose deaths were identified using death certificate statistical files for 1999–2015 from the Washington State Center for Health Statistics. Death certificates were corrected for misclassification of AI/AN race by conducting probabilistic record linkages between Washington death certificates and the Northwest Tribal Registry (a database of personal identifiers for AI/AN patients seen in IHS, tribal, and urban Indian health clinics in Idaho, Oregon, and Washington) (*3*). Washington death certificates were matched to the Northwest Tribal Registry using social security number, date of birth, name (last, first, and middle), and sex. Two staff members conducted clerical review of all potential matched pairs to identify true matches. AI/AN decedents included those with any mention of American Indian or Alaska Native background (regardless of Hispanic ethnicity) in the multiple race fields on the death certificate and those who matched with the Northwest Tribal Registry database but had no indication of AI/AN background on the death certificate (i.e., misclassified AI/AN records). AI/AN were compared with the majority white population to identify relative disparities in Washington. Uncorrected national and state-level estimates for 2013–2015 were obtained from the CDC WONDER Online Database for comparison.*

For both corrected and uncorrected data, total drug overdose deaths were identified as deaths with one of the following *International Classification of Disease, Tenth Revision* (ICD-10) codes for drug poisoning in the underlying cause of death field on the death record: X40–X44 (accidental poisoning by and exposure to drugs), X60–X64 (intentional self-poisoning by and exposure to drugs), X85 (assault by drugs), or Y10–Y14 (poisoning by and exposure to drugs, undetermined intent). Opioid-involved overdose deaths include the subset of drug overdose deaths with at least one of the following ICD-10 codes in the multiple cause of death fields: T40.0 (opium), T40.1 (heroin), T40.2 (other natural or semisynthetic opioids), T40.3 (methadone), T40.4 (other synthetic opioids), or T40.6 (other and unspecified narcotics). Heroin-involved overdose deaths include the subset of drug overdose deaths with heroin (ICD-10 code T40.1) listed in any multiple cause of death field. Trends were calculated as 3-year rolling averages of age-adjusted mortality rates during the period 1999–2015. Rates were age-adjusted to the U.S. 2000 standard population using National Center for Health Statistics (NCHS) vintage 2015 bridged race estimates as population denominators. For rates among AI/AN, 95% confidence intervals (CIs) were based on the gamma distribution to account for small cell sizes (*4*), and CIs for rates among whites were calculated using the normal approximation method. Metropolitan and nonmetropolitan counties were designated using the NCHS 2013 Urban-Rural Classification Scheme for Counties (*5*).† Link Plus v.2.0 was used to conduct the probabilistic record linkages, and statistical software was used to analyze the corrected Washington death certificates. Uncorrected drug and opioid-involved overdose counts, rates,

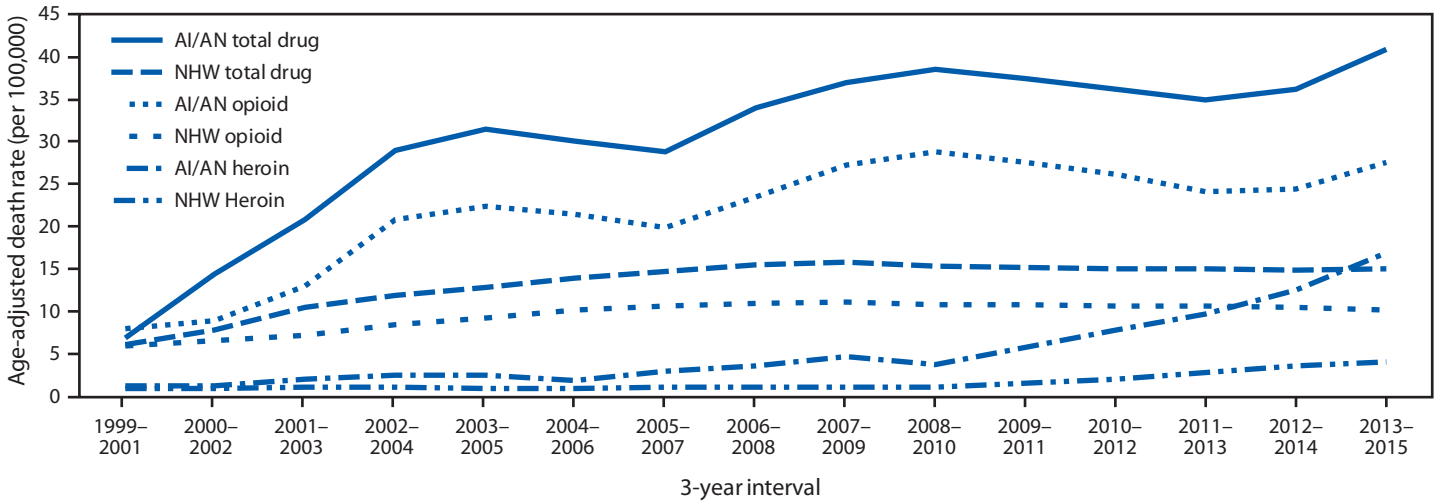
* Data are from NCHS Multiple Cause of Death Files, 1999–2015, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. https://wonder.cdc.gov/ucd-icd10.html.

† https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.

and CIs for the United States and Washington were obtained using Multiple Cause of Death Data from the CDC WONDER online database (https://wonder.cdc.gov/mcd.html).

During 1999–2001, based on death certificates corrected for AI/AN misclassification, AI/AN and whites in Washington had similar age-adjusted total drug, opioid-involved, and heroin-involved overdose mortality rates (Figure). Overdose death rates increased significantly for both groups in subsequent years; however, the increase was much sharper among AI/AN than among whites. During 2013–2015, 184 drug overdose deaths occurred among AI/AN in Washington, including 126 (68.5%) that involved opioids. The rates were higher for total drug (2.7 times), opioid-involved (2.7), and heroin-involved overdose mortality (4.1) among AI/AN than among whites (Table 1). Among AI/AN in Washington, the total drug overdose rate among males was 1.7 times that among females (Table 2). AI/AN aged 25–54 years had higher rates of drug overdose mortality than did those in younger and older age groups. Age-specific drug overdose mortality rates among AI/AN were almost twice those among whites. The majority

FIGURE. Age-adjusted death rates*,† for total drug,§ opioid-involved, and heroin-involved overdose deaths among American Indians/Alaska Natives and non-Hispanic whites — Washington, 1999–2015



Source: Washington Center for Health Statistics Death Files 1999–2015, corrected for AI/AN misclassification through linkage with the Northwest Tribal Registry.
Abbreviations: AI/AN = American Indian/Alaska Native; NHW = non-Hispanic white.
* Per 100,000 persons.
† Three-year rolling averages.
§ Total drug overdose deaths include opioid-involved and nonopioid-involved deaths; opioid-involved deaths include heroin-involved deaths.

TABLE 1. Corrected* and uncorrected age-adjusted total drug†, opioid-involved, and heroin-involved overdose mortality rates (per 100,000 population) and rate ratios for American Indians/Alaska Natives and non-Hispanic whites — Washington and United States, 2013–2015

		Type of drug overdose rate (95% CI)		
Race	**Population**	**Total drug†**	**Opioid-involved**	**Heroin-involved**
American Indian/Alaska Native	WA (corrected)	40.9 (35.1–48.0)	27.5 (22.8–33.5)	16.7 (13.1–21.6)
	WA (uncorrected)	28.7 (23.7–33.7)	19.6 (15.7–24.2)	11.9 (8.9–15.5)
	US (uncorrected)	13.2 (12.5–13.8)	7.6 (7.1–8.0)	2.4 (2.1–2.6)
White, non-Hispanic	WA (corrected)	15.1 (14.5–15.7)	10.2 (9.7–10.7)	4.1 (3.7–4.4)
	WA (uncorrected)	15.7 (15.0–16.3)	10.6 (10.1–11.2)	4.3 (4.0–4.6)
	US (uncorrected)	19.2 (19.1–19.3)	12.1 (12.0–12.2)	4.4 (4.4–4.5)
AI/AN:NHW rate ratios				
WA AI/AN:NHW (corrected)	—	2.7 (2.3–3.1)	2.7 (2.3–3.2)	4.1 (3.2–5.2)
WA AI/AN:NHW (uncorrected)	—	1.8 (1.3–2.6)	1.8 (1.5–2.3)	2.8 (2.1–3.6)
U.S. AI/AN:NHW (uncorrected)	—	0.69 (0.65–0.72)	0.63 (0.59–0.67)	0.55 (0.49–0.61)
WA AI/AN (corrected:uncorrected)	—	1.4 (1.0–2.1)	1.4 (1.1–1.8)	1.4 (1.0–2.0)

Sources: Washington Center for Health Statistics Death Files 2013–2015 linked with the Northwest Tribal Registry (corrected data); CDC WONDER online database, Multiple Cause of Death data 2013–2015 (uncorrected data).
Abbreviations: AI/AN = American Indian/Alaska Native; CI = confidence interval; NHW = non-Hispanic white; WA = Washington.
* Data are corrected for misclassification of AI/AN race through probabilistic record linkage with the Northwest Tribal Registry.
† Total drug overdose deaths include opioid-involved and nonopioid-involved deaths; opioid-involved deaths include heroin-involved deaths.

TABLE 2. Number and age-adjusted rates (per 100,000 population) of total drug overdose deaths for American Indians/Alaska Natives and non-Hispanic whites, by sex, age, and rural/urban residence — Washington, 2013–2015

Characteristic	American Indian/Alaska Native			Non-Hispanic white		
	No.	Rate (95% CI)	Rate ratio (95% CI)	No.	Rate (95% CI)	Rate ratio (95% CI)
Sex						
Male	116	51.8 (42.7–64.7)	1.7 (1.3–2.3)	1,422	17.6 (16.6–18.5)	1.4 (1.3–1.5)
Female	68	30.1 (23.3–39.2)	Referent	1,040	12.5 (11.7–13.4)	Referent
Age group (yrs)						
<25	18	8.4 (5.0–13.2)	Referent	157	3.7 (3.1–4.3)	Referent
25–39	59	57.0 (43.4–73.5)	6.8 (4.0–11.5)	628	20.8 (19.2–22.5)	5.6 (4.8–6.8)
40–54	76	89.7 (70.7–112.3)	10.7 (6.4–17.9)	974	30.8 (28.9–32.8)	8.3 (7.1–10.0)
≥55	31	39.4 (26.8–55.9)	4.7 (2.6–8.4)	703	14.4 (13.4–15.5)	3.9 (3.3–4.7)
County type of residence						
Metropolitan (urban)	160	43.3 (36.7–51.5)	1.4 (0.9–2.2)	2,195	15.9 (14.0–17.8)	1.1 (0.9–1.2)
Nonmetropolitan (rural)	24	30.5 (19.3–48.1)	Referent	267	15.0 (14.3–15.7)	Referent

Source: Washington Center for Health Statistics Death Files 2013–2015, corrected for AI/AN misclassification through linkage with the Northwest Tribal Registry.
Abbreviation: CI = confidence interval.

of drug overdose deaths among AI/AN and whites occurred among Washington residents living in metropolitan (urban) counties. Among whites, similar rates of drug overdose deaths occurred among urban and rural residents; the overdose death rate among urban-dwelling AI/AN was 1.4 times that of AI/AN living in rural areas, although this difference was not statistically significant. The demographic distributions for opioid-involved and heroin-involved overdose deaths were similar to those observed for total drug overdose deaths.

During 2013–2015, based on CDC WONDER data uncorrected for AI/AN misclassification, in the United States, AI/AN had lower total drug, opioid-involved, and heroin-involved overdose mortality rates than those among whites (Table 1). Even before correction for AI/AN misclassification, AI/AN in Washington had higher drug, opioid-involved, and heroin-involved overdose mortality rates than did whites in Washington and AI/AN in the United States. Compared with Washington death certificates corrected for AI/AN misclassification, CDC WONDER data underestimated overdose mortality counts and rates among AI/AN in Washington by approximately 40% (Table 1).

Discussion

Since 1999, the rate of increase in drug, opioid-involved, and heroin-involved overdose deaths among AI/AN in Washington has outpaced that among whites. In recent years, AI/AN in Washington experienced total drug and opioid-involved overdose mortality rates that were 2.7 times higher than those of whites in the state. The prevalence and disparity experienced among AI/AN in Washington differ from overdose mortality patterns observed at the national level, which indicate that U.S. whites experience significantly higher mortality rates from drug, opioid-involved, and heroin-involved overdoses than do U.S. AI/AN (Table 1).

Summary

What is already known about this topic?

Nationally, American Indians and Alaska Natives (AI/AN) have experienced the largest increases in drug and opioid-involved overdose mortality rates compared with other racial/ethnic groups. Misclassification of AI/AN race is known to underestimate AI/AN mortality rates.

What is added by this report?

During 2013–2015, total drug and opioid-involved overdose mortality rates for AI/AN were 2.7 times higher than those of whites in Washington. Misclassification of AI/AN race in death certificates underestimated Washington AI/AN overdose mortality by approximately 40%.

What are the implications for public health practice?

Probabilistic linkages to correct misclassified race can improve accuracy of data on drug overdose mortality for AI/AN in Washington, which is important for state and federal resource allocation and program direction. Additional efforts are needed for community-based substance-use disorder surveillance, treatment, and prevention in AI/AN communities.

AI/AN communities experience high rates of physical, emotional, and historical trauma and significant socioeconomic disparities, which might contribute to higher rates of drug use in these communities (*5*). AI/AN also face barriers to receiving quality medical and behavioral health care, resulting in part from longstanding underfunding of the Indian Health Service (IHS), tribal, and urban Indian clinics, as well as stigma associated with accessing behavioral health care in some communities (*6*). The differences in corrected and uncorrected rate estimates demonstrate the importance of accurately recording race on death certificates. Without the probabilistic linkage correction, uncorrected Washington death certificates underestimated overdose mortality rates among AI/AN by 40%. Misclassification of AI/AN in public health data can

obscure the prevalence of disease and result in suppression of health statistics because of small numbers, which could affect the ability of state and federal programs to direct resources needed for a robust public health response to this epidemic.

The findings in this report are subject to at least six limitations. First, not all AI/AN in Washington seek care at IHS, tribal, or urban Indian health facilities, and thus, they would not have been included in the linkage. The Northwest Tribal Registry is known to underrepresent persons living in urban areas (*7*). Therefore, the actual number of drug overdose deaths and corresponding mortality rates among AI/AN might be higher than those reported in this analysis. Second, human error and bias might have been introduced during the probabilistic linkage process, particularly during clerical review of matched record pairs. Although double clerical review was employed as a strategy to decrease the introduction of bias, the possibility remains that human error could have resulted in the underascertainment or overascertainment of misclassified AI/AN records. Third, the NCHS bridged race estimates used as population denominators are known to inflate the Hispanic AI/AN population in the United States and therefore, result in the underestimation of mortality rates among AI/AN that include Hispanic AI/AN (*8*). Fourth, the circumstances under which toxicologic testing for drugs occurs and the testing methods themselves have changed over time (*1*), and these changes might account for some of the observed increases in drug and opioid-involved overdose deaths. Fifth, some heroin-involved deaths might have been misreported as morphine-involved deaths because of the similarity in metabolism of these two substances (*1*). Finally, this analysis of linkage-corrected death certificates was restricted to one state, which limits the generalizability of findings to AI/AN in other states.

Efforts that address the opioid epidemic are underway in tribal and urban AI/AN communities throughout the United States and rely on strong partnerships between tribal governments, regional Indian health boards, IHS and other federal agencies, tribal epidemiology centers, and local and state governments. IHS is addressing the epidemic in clinical settings through new prescribing policies, education for providers, and increased access to medication-assisted treatment and naloxone for first responders, in partnership with the Bureau of Indian Affairs (*9*). Additional efforts are needed for community-based surveillance, treatment, and prevention that address the variability in substance use disorder risk factors and outcomes across tribal and urban AI/AN communities. Programs that incorporate evidence-based strategies while addressing the diverse cultures, resources, and priorities of AI/AN communities might prove most effective in addressing current and future drug epidemics (*5*).

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Rabies in a Dog Imported from Egypt — Connecticut, 2017

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In 2007, the United States successfully eliminated canine rabies virus variant. Globally, however, dogs remain the principal source of human rabies infections. Since 2007, three cases of canine rabies virus variant were reported in dogs imported into the United States, one each from India (2007), Iraq (2008), and Egypt (2015) (*1*–*3*). On December 20, 2017, a dog imported into the United States from Egypt was identified with rabies, representing the second case from Egypt in 3 years. An Egyptian-based animal rescue organization delivered four dogs from Cairo, Egypt, to a flight parent (a person solicited through social media, often not affiliated with the rescue organization, and usually compensated with an airline ticket), who transported the dogs to the United States. The flight parent arrived at John F. Kennedy International Airport (JFK) in New York City and, via transporters (persons who shuttle dogs from one state to another), transferred the dogs to foster families; the dogs ultimately were adopted in three states. The Connecticut Department of Public Health Laboratory (CDPHL) confirmed the presence of a canine rabies virus variant in one of the dogs, a male aged 6 months that was adopted by a Connecticut family. An investigation revealed the possibility of falsified rabies vaccination documentation presented on entry at JFK, allowing the unvaccinated dog entry to the United States. This report highlights the continuing risk posed by the importation of dogs inadequately vaccinated against rabies from high-risk countries and the difficulties in verifying any imported dog's health status and rabies vaccination history.

Case Report and Findings

On December 20, 2017, a shipment of four rescue dogs arrived at JFK from Cairo, Egypt. Two transporters and one owner retrieved the dogs, with planned distribution to foster homes and permanent owners in Connecticut, Maryland, and Virginia. A fifth dog on the flight, traveling with a separate flight parent and not part of this shipment, shared the cargo hold and was temporarily housed in New Jersey and West Virginia before reaching its Washington destination. One of the four dogs, a male Chihuahua mix aged 6 months (dog A), was noticeably agitated and bit the flight parent before boarding the plane in Egypt. Dog A was imported with tooth fractures and exposed maxillary bone, reportedly from being struck by a car in autumn 2017.

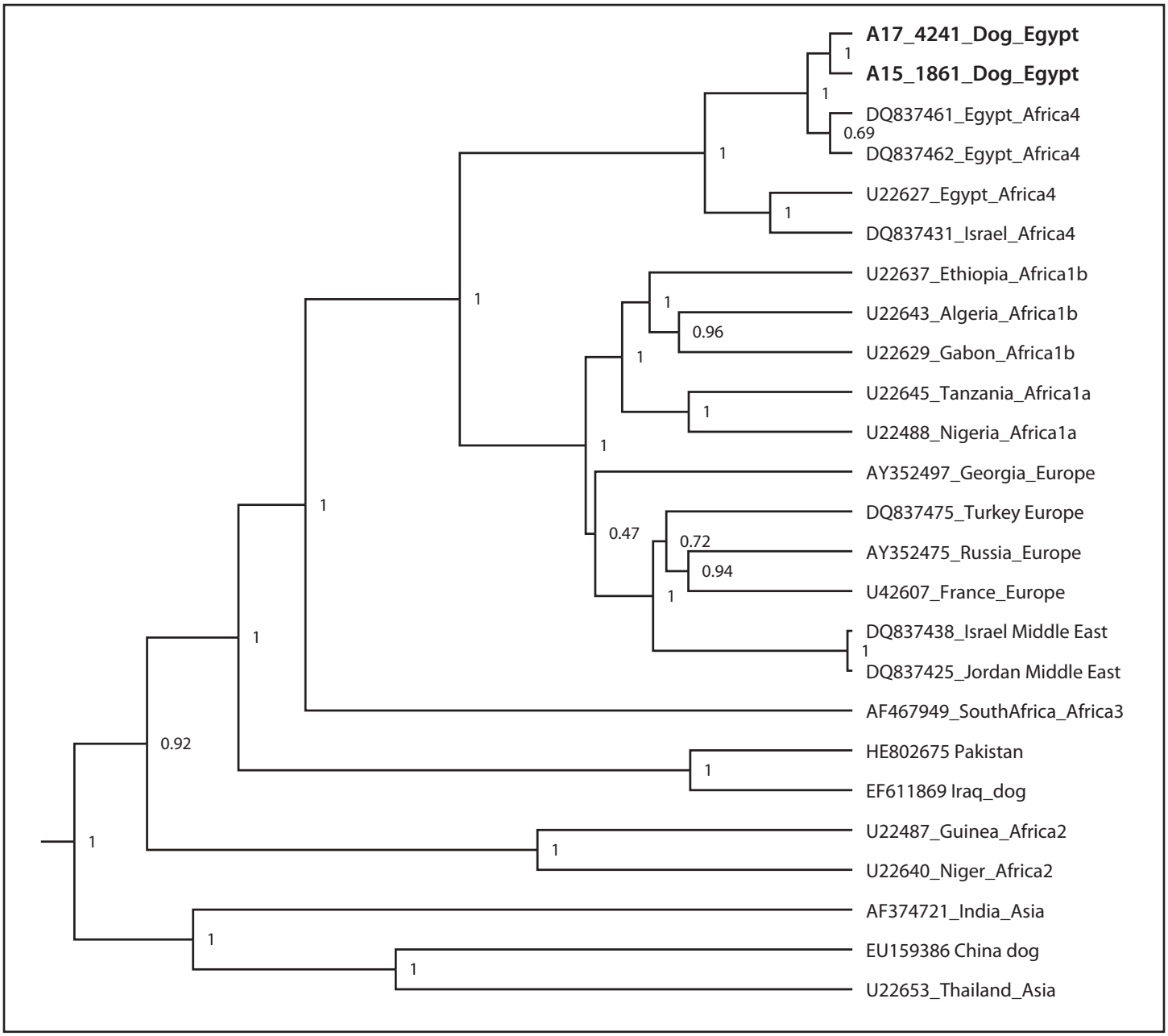
On assessment at a Connecticut veterinary clinic on December 21, dog A exhibited hyperesthesia (increased sensitivity to stimuli) and paresis. The dog bit a veterinary technician during a blood draw procedure and died shortly thereafter. The clinic submitted brain tissue for rabies testing to CDPHL. On December 26, CDPHL confirmed rabies virus infection by direct fluorescent antibody testing and informed CDC. On December 28, CDC confirmed the direct fluorescent antibody results and determined the variant was consistent with Africa 4 subspecies canine rabies virus circulating in Egypt (Figure).

Public Health Investigation

After CDPHL's notification of confirmed rabies, CDC's New York Quarantine Station initiated a contact investigation to identify animals or persons potentially exposed to dog A during its infectious period (10 days before symptom onset until death [December 9–21]). CDC contacted health departments in the chain of distribution of all five dogs in the cargo hold to initiate rabies exposure assessments; these health departments included the Maryland Department of Health, Virginia Department of Health, New York City Department of Health and Mental Hygiene, New York State Department of Health and Mental Hygiene, and Washington State Department of Health. The investigation also included U.S. Customs and Border Protection (CBP), the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, the airline that transported the animals, and the domestic cargo offloading company at JFK.

State health department staff members interviewed dog A's caretakers, volunteers, and employees associated with the involved rescue groups and veterinary hospital staff members for potential exposure. Public health investigators for Maryland, New Jersey, New York, Washington, and West Virginia determined that the animal transporters and foster home volunteers had no direct contact with dog A; therefore, no postexposure prophylaxis (PEP) was recommended for those persons. Connecticut public health officials, in accordance with national guidelines (*4*), recommended PEP for the flight parent bitten in Cairo, the caretakers of dog A, and the veterinary technician who was bitten. CDC and CBP conducted a contact investigation to identify potentially exposed persons and animals at JFK. CBP interviewed the airline's U.S.-based cargo staff members and reviewed surveillance

FIGURE. Egyptian dog (bolded for both 2017 and 2015 isolates groups) with other available Egyptian strains as Africa 4 subspecies canine rabies virus (RABV Africa 4) subspecies*



* Phylogenetic tree is constructed from 1,350 nucleotides of nucleoprotein gene using BEAST program (http://beast.community). Posterior probabilities were labeled at each branch with probability values between 0 and 1. Branch length is related to the number of nucleotide substitutions. The more substitutions, the longer the branch. More evolved strains will be further from their ancestor.

video to identify transporters and CBP staff members who had potential exposure to dog A. CBP identified 13 cargo and baggage handlers and four CBP officers; New York City Department of Health and Mental Hygiene conducted risk assessments and determined that PEP was not recommended. All handlers reportedly wore gloves while handing the crates and had no direct contact with the dogs. CBP reviewed the importation paperwork and cleared the animals but had no physical contact with the dogs or the crates.

The domestic animal exposure investigations determined that all four dogs in the Egyptian shipment (dogs A, B, C, and D) were individually crated within the airplane cargo hold. A fifth dog (dog E, also in an individual crate), that was not part of the rescue organization shipment, shared the

same cargo hold space. The animals were never removed from the crates during shipment, so they could not have had direct contact with dog A. Therefore, dogs B, C, D, and E were not considered exposed to dog A during transport. Dog A had no contact with any dogs after exiting the airport and was placed in isolation at the veterinary clinic. All five dogs had certificates indicating rabies vaccination both at ≥3 months and ≥30 days before arrival at a U.S. port of entry (Table), as required by CDC dog importation regulations (*5*). However, because dog A's infection raised uncertainty about the validity of rabies vaccination for the five dogs, investigators determined that the four remaining dogs from the shipment should receive a rabies booster vaccination followed by confinement, as recommended by the Compendium of Animal Rabies Prevention and Control (*6*). In light of this uncertainty and the potential for unreported exposure before shipment, Maryland Department of Health elected to confine dogs B and C for 4 months; Virginia Department of Health and Washington State Department of Health elected to confine dogs D and E for 30 days (Table). Egyptian public health investigators instituted vaccination, confinement, and monitoring for four other dogs in the Egyptian rescuer's possession and indicated that persons exposed to dog A were given PEP. Clarification by Egyptian authorities of why an appropriately vaccinated dog (according to the documentation provided) developed rabies is pending.

Summary

What is already known about this topic?

Public health challenges associated with the global movement of animals include importation of canine rabies virus variant into the United States from countries where the virus is enzootic.

What is added by this report?

A rabid dog imported into the United States from Egypt, with documentation of rabies vaccination but no medical history, resulted in a six-state investigation and administration of rabies postexposure prophylaxis to multiple persons.

What are the implications for public health practice?

Use of flight parents who have no medical history for the dog they are transporting poses a potential human and animal health threat. To prevent reintroduction of the canine rabies virus variant, the United States needs to continue vigilance at ports of entry, domestic surveillance infrastructure, and high dog vaccination coverage.

Discussion

Elimination of the canine rabies virus variant from the United States required approximately 5 decades and hundreds of millions of dollars. Imported cases present an ongoing opportunity for reestablishment of the variant and require lengthy and costly investigations to prevent additional cases in both humans and animals.

This report describes the sixth importation of a rabid dog into the United States in the past 15 years and the third from the Middle East; all six were rescued dogs (*1*–*3*,*7*,*8*). Rabies in dogs might be underreported in the United States because rabies can have a variable clinical course that might not prompt animal owners to seek postmortem rabies testing (*9*). Previous reports and publications have discussed the public health challenges associated with the global movement of animals in commerce and the federal, state, and local authorities involved with dog importation (*1*–*3*,*7*,*8*). The United States has one of the most robust rabies surveillance and response networks in the world, with approximately 120 diagnostic laboratories testing approximately 100,000 animals every year. This network of clinical veterinarians, public health practitioners, and rabies diagnostic laboratories improves the chances of early detection of cases and termination of transmission chains. A high level of background vaccination in most U.S. dog populations also serves as a barrier to this disease. This surveillance network rapidly identified these six documented events, and none has resulted in transmission in U.S. dogs.

CDC and local and state agencies have received reports of invalid or questionable health and rabies vaccination certificates for imported dogs (*9*). The inadequacy of dog A's rabies vaccination could have been caused by vaccination failure, improperly stored vaccine, or fraudulent documentation.

TABLE. Date or year of birth and reported rabies vaccination or revaccination dates for five dogs shipped from Egypt to the United States on December 20, 2017

	Information provided on Egyptian rabies vaccination certificate		Vaccination or revaccination after arrival in the United States		
Dog	Date or year of birth	Date of rabies vaccination	Final U.S. destination	Date of U.S. rabies vaccination or revaccination	End (duration) of confinement*
A	Jun 10, 2017	Sep 14, 2017	Connecticut	N/A	N/A
B	2013	Nov 22, 2017	Maryland	Jan 5, 2018	May 5, 2018 (4 months)
C	Jun 9, 2017	Nov 2, 2017	Maryland	Dec 26, 2017	Apr 26, 2018 (4 months)
D	2012	Oct 27, 2017	Virginia	Dec 27, 2017	Jan 26, 2018 (30 days)
E	Apr 6, 2016	Nov 4, 2017	Washington	Dec 28, 2017	Jan 27, 2018 (30 days)

* Includes CDC-required confinement period of 30 days after vaccination and individual state requirements for rabies postexposure quarantine.

Vaccination failure is rare when rabies vaccine is properly stored and administered; no other vaccination issues were reported from the manufacturer with the lot used in dog A. In addition, dog A was apparently not part of the original shipment agreed to by the flight parent, who had no medical history for dog A. Accepting rescue dogs or other animals without knowing their histories or having personal knowledge about the accuracy of veterinary documents can lead to the unnecessary exposure of persons and animals to a lethal zoonotic disease.

To prevent the reintroduction of the canine rabies virus variant, the United States needs to continue vigilance at ports of entry, domestic surveillance infrastructure, and dog vaccination coverage. At U.S. ports of entry, there is a visual inspection for death or signs of illness that prompts a required necropsy or veterinary examination under CDC's regulations. However, the signs typical of rabies (e.g., agitation, barking, aggressiveness, and altered mental status) also are common in stressed dogs during long-distance travel, and, unless the animal is near death, ill dogs could be overlooked. Increased education of rescue organizations both domestically and internationally and enhanced focus on dogs from countries where canine rabies virus variant is circulating could help increase awareness of the significance of rabies control in dog importations and reduce the potential for importation of cases.

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Trends and Gaps in National Blood Transfusion Services — 14 Sub-Saharan African Countries, 2014–2016

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Ensuring availability of safe blood products through recruitment of voluntary, nonremunerated, blood donors (VNRDs) and prevention of transfusion-transmissible infections (TTIs), including human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and syphilis, is important for public health (*1*,*2*). During 2004–2016, the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) provided approximately $468 million in financial support and technical assistance* to 14 sub-Saharan African countries† with high HIV prevalence to strengthen national blood transfusion services (NBTSs)§ and improve blood safety and availability. CDC analyzed these countries' 2014–2016 blood safety surveillance data to update previous reports (*1*,*2*) and summarize achievements and programmatic gaps as some NBTSs begin to transition funding and technical support from PEPFAR to local ministries of health (MOHs) (*2*,*3*). Despite a 60% increase in blood supply since 2004 and steady declines in HIV prevalence (to <1% among blood donors in seven of the 14 countries), HIV prevalence among blood donors still remains higher than that recommended by the World Health Organization (WHO) (*4*). PEPFAR support has contributed to significant reductions in HIV prevalence among blood donors in the majority of PEPFAR-supported countries, and linking donors who screen HIV-positive to confirmatory testing and indicated treatment, as well as further reducing TTIs, remains a public health priority (*5*).

In 2016, WHO Global Status Report on Blood Safety and Availability¶ reported that 5.6 million units of blood (4% of the global supply) were collected in Africa; 38 African countries collected <10 whole-blood donations per 1,000 population, the WHO-recommended target (*1*). To meet demand, countries often rely on family or replacement donors who donate blood for a family member or friend; however, such donations carry a higher risk for TTIs (*6*). Since 2004, PEPFAR support has helped establish national blood policies, improved blood donor screening, increased recruitment and reliance on VNRDs for national supplies, and strengthened laboratory infrastructure, accreditation, information systems, and continuous quality improvement programs (*4*).

During 2014–2016, NBTSs in the 14 PEPFAR-supported sub-Saharan African countries used a standardized data collection tool to report the total number of blood units collected; the percentage of donated units that screened positive for HIV and other TTIs; the percentage of screen-positive donors who were notified of their result; and the status of financial support transition from PEPFAR to MOHs. MOH funding to support blood safety activities at the local NBTS was self-reported to the PEPFAR and CDC-supported WHO Global Database on Blood Safety. The numbers of whole blood units collected per 1,000 population per year were calculated using national census estimates or United Nations population projections.**

During 2004–2016, overall total annual blood collections in PEPFAR-supported countries increased 60%, from 1,469,561 units in 2004 to 2,352,905 units in 2016, although collection rates remain below WHO recommendations (*1*) in all countries except South Africa and Swaziland (Table 1). From 2014 to 2016, the number of units collected per 1,000 population decreased in five countries (Kenya, Lesotho, Nigeria, Swaziland, and Zambia); however, during this period, eight countries reported collecting 100% of their national blood supply from VNRDs. The largest increase in VNRD donations (40%) occurred in Ethiopia (from 70% in 2014 to 98% in 2016); however, declines in VNRD donations in Lesotho (18%, from 96% to 79%) and Tanzania (11%, from 89% to 79%) also occurred.

In all 14 countries, most blood donors were men (65% in 2014 and 86% in 2016); however, from 2014 to 2016, the number of female blood donors aged 20–24 years increased approximately thirtyfold, from 4,424 in 2014 to 146,571 in 2016. The largest increase in male donors (201%) occurred among persons aged 30–34 years, from 45,725 in 2014 to 137,596 in 2016.

* Blood Safety programs are funded through the Human Movement Blood Laboratories budget code.

† Côte d'Ivoire, Ethiopia, Ghana, Kenya, Lesotho, Mozambique, Nigeria, Rwanda, South Africa, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe. A full list of countries receiving PEPFAR support is available at https://www.pepfar.gov.

§ National blood transfusion services refers to those government or nongovernmental organizations with a legal mandate to collect, test, process, and distribute blood and blood components within a given country, or the legal authority to oversee or regulate the collection, testing, processing, and distribution of blood and blood components by other entities within that country.

¶ https://www.who.int/bloodsafety/global_database/en/.

** Africa Society for Blood Transfusion accreditation lasts for 2 years; Namibia was accredited in 2012.

TABLE 1. Number of blood units collected by U.S. President's Emergency Plan for AIDS Relief (PEPFAR)–supported blood transfusion services, number of blood units from voluntary nonremunerated donors (VNRDs), and blood units collected per 1,000 population, by country — 14 PEPFAR-supported countries, 2004 and 2014–2016

	2004			2014			2015			2016		
Country	No. collected	% VNRD	No. per 1,000 population	No. collected	% VNRD	No. per 1,000 population	No. collected	% VNRD	No. per 1,000 population	No. collected	% VNRD	No. per 1,000 population
Côte d'Ivoire	77,972	100	3.4	143,691	100	6.3	155,534	100	6.8	168,025	100	7.4
Ethiopia	43,247	59	0.4	87,685	70	0.8	140,061	97	1.4	173,923	98	1.7
Ghana	165,426	41	6.0	150,322	30	5.4	155,250	34	5.6	160,624	36	5.8
Kenya	18,440	100	0.4	183,475	100	3.9	155,081	100	3.3	167,100	100	3.6
Lesotho	3,000	95	1.4	8,373	96	3.9	7,879	97	3.7	5,008	79	2.3
Mozambique*	67,105	58	3.4	121,091	39	4.3	126,068	42	4.5	131,231	45	4.6
Nigeria†	1,266	100	<0.1	48,908	91	0.2	66,614	82	0.3	51,329	84	0.2
Rwanda	28,777	100	2.4	42,789	100	3.6	53,436	100	4.6	61,768	100	5.3
South Africa	709,324	100	13.0	803,818	100	14.7	828,689	100	15.2	810,895	100	14.8
Swaziland	7,060	100	5.4	14,727	100	11.3	13,752	100	10.5	13,687	100	10.5
Tanzania§	129,404	66	2.4	128,915	89	2.4	67,980	49	1.2	196,735	79	3.6
Uganda	112,250	100	2.8	212,939	100	5.4	230,995	100	5.9	243,335	100	6.2
Zambia	38,477	71	2.3	109,269	100	6.7	100,110	100	6.1	104,355	100	6.4
Zimbabwe	67,813	100	4.3	58,603	100	3.7	59,767	100	3.8	64,890	100	4.1
Total	**1,469,561**	**—**	**2.2**	**2,114,605**	**—**	**3.4**	**2,161,216**	**—**	**3.6**	**2,352,905**	**—**	**3.8**

Source: 2004, 2014–2016 population data from the Joint United Nations Programme on HIV and AIDS. http://aidsinfo.unaids.org/.
Abbreviations: AIDS = acquired immunodeficiency syndrome; HIV = human immunodeficiency virus.
* 2004 data for Mozambique from https://www.cdc.gov/mmwr/volumes/65/wr/mm6505a4.htm.
† Nigeria and Tanzania did not have data for 2004; therefore, data for 2003 and 2005 were used.

During 2014–2016, the prevalence of whole blood units screening positive for HIV declined in 10 countries (range = 0.1–1.2 percentage-point declines) but increased in Nigeria (by 0.1 percentage point), Rwanda (0.1) and Swaziland (1.2) (Table 2). The HIV screening prevalence among donated units in seven countries remains higher than the WHO target of <1% (*4*). During 2014–2016, in nine countries with information on informing donors of HIV screening results, only 18.0% (2,971 of 16,539 [2014]) to 27.6% (3,660 of 13,269 [2016]) of donors who screened HIV-positive were notified of their results (Figure). During this period, the total number of deferrals remained steady (>250,000 units); however, deferrals attributable to high-risk behavior declined from 2014 to 2015.

From 2014 to 2016, the prevalence of HBV, HCV, and syphilis reactivity in donated blood units decreased in six countries; decreases ranged from 0.1 percentage point (Tanzania) to 1.3 percentage points (Mozambique) (Table 2). The prevalence of TTIs in donated units increased in seven countries (Côte d'Ivoire, Ghana, Lesotho, Nigeria, Rwanda, South Africa, Swaziland, and Uganda) (Table 2). In 2016, the percentage of donated blood units that screened positive for all TTIs ranged from 0.7 (South Africa) to 14.6 (Nigeria).

As support for local blood safety programs transitioned to MOHs from PEPFAR, MOHs in Ethiopia, Swaziland, and Tanzania completely absorbed the cost of collecting and testing blood in 2016. Nine of 12 countries with available data report ≥50% of MOH support to the NBTS (Supplementary Table, https://stacks.cdc.gov/view/cdc/61188).

Discussion

Sub-Saharan African countries have improved access to safe and adequate blood supplies, but continued commitment and funding are required to maintain gains and achieve WHO targets. Although the number of blood units collected has increased since 2004, whole blood collections remain insufficient to meet national demand: 12 of 14 evaluated countries do not meet the WHO-recommended target (*1*). This shortfall especially affects women with pregnancy-related complications, trauma victims, and children with severe life-threatening malaria-related anemia (*7*).

Although most of the 14 PEPFAR-supported countries reported decreases in the percentage of collected blood units that screened positive for HIV since 2004, percentages remain significantly higher than the 0.003% reported by high-income countries (*1*). Seven countries have HIV screen-positive rates that exceed the WHO recommended target of <1.0%. Although HIV prevalence rates among blood donors have decreased, prevalences of other TTIs such as HBV, HCV, and syphilis increased in seven countries. To reduce the risk for TTIs in sub-Saharan Africa when PEPFAR support ends, MOHs can participate in cross-sector collaborations to implement blood bank quality and safety accreditation standards through the African Society for Blood Transfusion (AfSBT)†† or other international accrediting bodies and implement PEPFAR-supported blood safety information systems. Recent data indicate that 50% of PEPFAR-supported countries still do

†† https://afsbt.org/.

TABLE 2. Population prevalence of human immunodeficiency virus (HIV) infection among persons aged 15–49 years in the general population, percentage of collected blood units reactive for HIV, and percentage of collected blood units reactive for three transfusion-transmissible infections (TTIs) (hepatitis B virus [HBV], hepatitis C virus [HCV], and syphilis), by country — 14 U.S. President's Emergency Plan for AIDS Relief–supported countries, 2014–2016*

				Prevalence (%) of TTIs in collected blood units								
							Other TTIs			All TTIs		
	HIV population prevalence (%)			HIV			HBV, HCV, and syphilis			HIV, HBV, HCV, and syphilis		
Country	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
Côte d'Ivoire	**3.0**	**2.8**	**2.7**	**0.3**	**0.04**	**0.2**	**8.6**	**9.0**	**8.9**	**9.0**	**9.0**	**9.1**
Ethiopia	1.1	1.1	0.9	2.1	1.2	1.1	4.4	4.6	4.2	5.2	5.1	4.5
Ghana	1.7	1.6	1.6	0.7	0.5	0.3	9.7	7.1	11.6	11.8	8.3	12.7
Kenya	5.7	5.6	5.4	0.6	0.8	0.6	2.8	4.3	2.5	3.5	5.2	3.2
Lesotho	24.7	24.9	25	2.6	2.4	2.5	3.6	3.8	5.0	6.2	6.2	7.6
Mozambique	13.0	12.7	12.3	5.2	4.8	4.0	8.2	8.8	6.9	13.4	13.6	11.0
Nigeria	3.1	3.0	2.9	1.4	1.4	1.5	11.3	11.7	13.1	12.9	13.2	14.6
Rwanda	3.2	3.2	3.1	0.1	0.1	0.2	2.6	2.7	3.4	2.8	2.9	3.6
South Africa	18.8	18.9	18.9	0.2	0.2	0.1	0.3	0.3	0.5	0.5	0.5	0.7
Swaziland	27.6	27.5	27.2	0.7	1.5	1.9	1.6	3.0	5.6	2.4	4.6	7.6
Tanzania	6.9	6.7	6.5	1.4	1.5	1.3	7.7	14.3	7.6	9.2	10.8	8.9
Uganda	5.0	4.8	4.7	0.9	0.6	0.6	3.4	4.2	3.8	4.3	4.8	4.4
Zambia	12.7	12.6	12.4	3.4	2.9	2.9	8.1	7.1	7.0	11.6	10.1	10.0
Zimbabwe	14.3	13.9	13.5	0.5	0.4	0.4	0.6	0.4	0.4	1.1	0.8	0.8

Source: 2014–2016 from United Nations Development Program population estimates. http://hdr.undp.org/en/data#.
Abbreviation: AIDS = acquired immunodeficiency syndrome.
* Self-reported data for 2014, 2015, and 2016.

not have a computerized information system for blood donor tracking and TTI testing. Since 2016, blood safety information systems have been implemented in three countries, with another two planned by 2019. To date, only four NBTSs in sub-Saharan Africa (Namibia [accredited in 2012], South Africa, Rwanda, and Tanzania) have achieved accreditation by an external body. Seven countries are currently in various stages of the accreditation process through AfSBT. Global CDC blood safety targets are that 50% of NBTS sites reach at least the first of three accreditation steps under AfSBT during the next 2–3 years.

As countries move toward the United Nations 95–95–95 targets (95% of HIV infection diagnosed, 95% of infected persons receiving antiretroviral therapy [ART], and 95% of those on ART achieving viral suppression) for achieving epidemic control, increasing outreach to priority populations for testing and preventive services become increasingly important (*8*). Currently, no systems exist within these NBTSs to link persons determined to be ineligible for donation through behavioral risk screening to HIV testing and preventive services.

During 2014–2016, four NBTSs transitioned from PEPFAR to full MOH funding. An additional five countries received ≥50% of their funding from MOHs; two countries reported a decrease in MOH funding. As PEPFAR transitions occur, countries should consider prioritization of funding to their NBTS to sustain the gains achieved (*9*).

The findings of this report are subject to at least four limitations. First, blood unit collections described in this report only represent units collected by the NBTS, and do not account for units collected in the private sector or by nonnational blood transfusion services. Second, variations in testing capacity and assays used for laboratory screening (most NBTSs lack HBV and HCV confirmatory testing) might result in over- or underestimation of TTI prevalence rates among blood donors. Third, lack of information systems to link donors who screen HIV-positive to treatment services might result in inaccurate

Summary

What is already known on this topic?

Since 2004, the U.S. President's Emergency Plan for AIDS Relief has improved blood availability and safety in 14 sub-Saharan African countries; however, the risk for human immunodeficiency virus (HIV) transmission via transfusion remains unacceptably high.

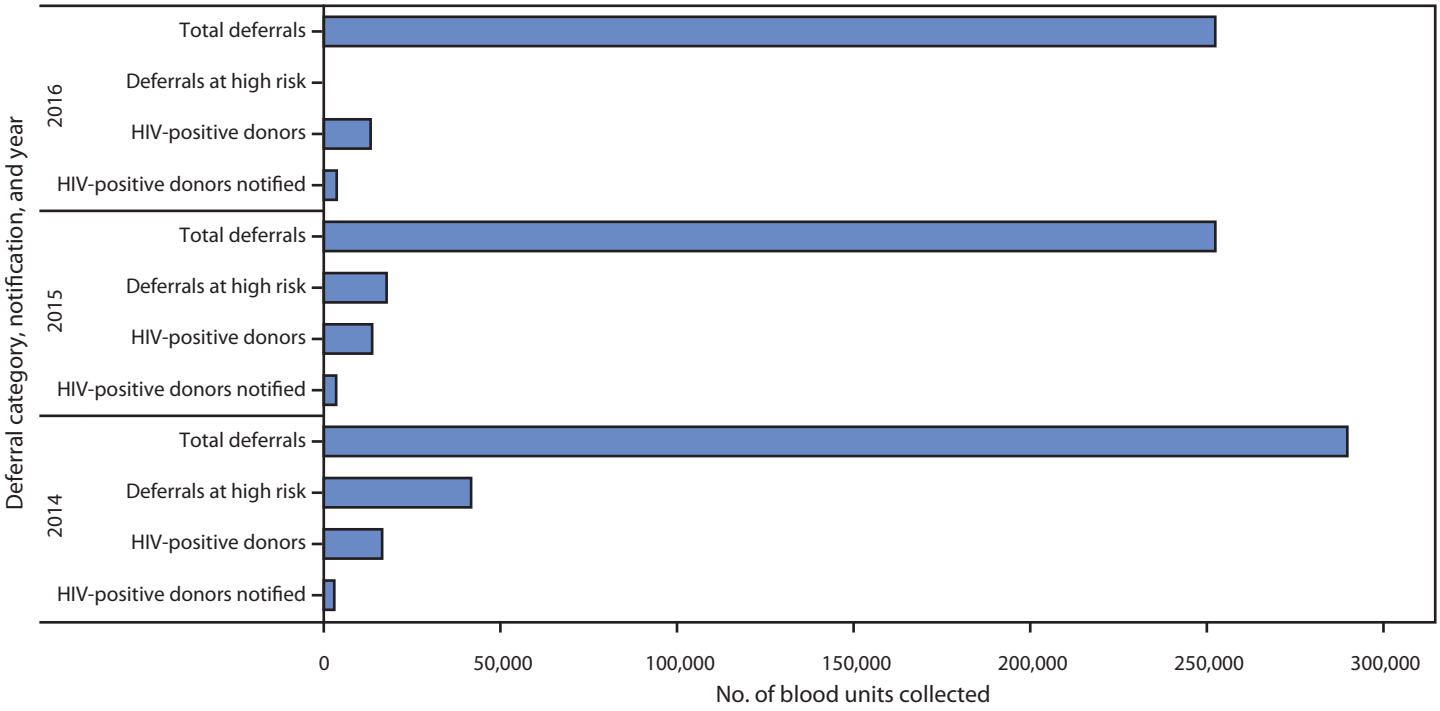
What is added by this report?

During 2014–2016, blood collections increased and donor HIV prevalence decreased in seven of the 14 countries, but systems to link HIV-positive and donors at high risk to testing and treatment are inadequate.

What are the implications for public health practice?

Sustained investments by ministries of health in continuous quality improvement, national blood transfusion services accreditation, linkage of HIV-positive and donors at risk to testing, care, and treatment, and blood safety information systems remain important components to ensure the viability of blood safety programs.

FIGURE. Total number* of blood units collected for all deferrals,† deferrals at high risk,§,¶ human immunodeficiency virus (HIV)–positive donors, and HIV-positive donors notified of their HIV status, by year — nine U.S. President's Emergency Plan for AIDS Relief–supported countries, 2014–2016††**



Abbreviation: AIDS = acquired immunodeficiency syndrome.

* Total number of blood units collected: 1,583,617 in 2014; 1,590,104 in 2015; and 1,771,798 in 2016.

† Deferrals are defined as donors who do not meet donor selection criteria after administration of a risk assessment questionnaire.

§ Deferrals at high risk, classified based on seven categories of behavior; data for number of deferrals at high risk from Global Database for Blood Safety.

¶ Percentage of deferrals at high risk from total blood units collected: 2014, 14%; 2015, 7%; and 2016, data not available.

** Ethiopia, Kenya, Nigeria, Rwanda, South Africa, Swaziland, Tanzania, Uganda, and Zambia.

†† Number of deferrals at high risk for 2016 was not available.

estimations of the number of donors who are notified about their status. Finally, self-reported data from countries might result in inaccurate estimations.

A decade of PEPFAR support to NBTSs in 14 countries has led to increases in blood collections, fewer donors screening HIV-positive, and transition of support from PEPFAR to MOHs. However, gaps in linking deferred donors at high risk to HIV testing and prevention services, and in notifying HIV-positive donors of their status and linking them to confirmatory testing, care, and treatment underscore the need for enhanced focus on epidemic control, as well as innovative strategies to address donors who test positive for other TTIs. Ending reliance on unsafe blood donors requires continued investment in laboratory quality improvement, including increased engagement in external proficiency testing and increased use of highly sensitive assays at the NBTS and non-NBTS testing sites. Continued improvement of blood safety programs in sub-Saharan Africa will require sustained investments in continuous quality improvement, NBTS accreditation under AfSBT, linkage of deferred donors who report high risk behaviors and those who screen HIV-positive to HIV testing services and treatment, and stronger blood safety information systems. Strengthening health systems and developing local policy and sustainable financial resources are all important components to consider to ensure the future viability of blood safety programs.

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Notes from the Field

Infections After Receipt of Bacterially Contaminated Umbilical Cord Blood–Derived Stem Cell Products for Other Than Hematopoietic or Immunologic Reconstitution — United States, 2018

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The only Food and Drug Administration (FDA)–approved stem cell products are derived from umbilical cord blood, and their only approved use is hematopoietic and immunologic reconstitution (*1*). On September 17, 2018, the Texas Department of State Health Services received notification of *Enterobacter cloacae* and *Citrobacter freundii* bloodstream infections in three patients who had received injections or infusions of non-FDA–approved umbilical cord blood-derived stem cell products processed by Genetech, Inc., and distributed by Liveyon, LLC, for other than hematopoietic or immunologic reconstitution at an outpatient clinic on September 12. Patient isolates of *E. cloacae* had identical pulsed-field gel electrophoresis patterns, suggesting a common source. On September 22, the Florida Department of Health received notification of *Escherichia coli*, *Enterococcus faecalis,* and *Proteus mirabilis* joint infections in four patients who had received injections of these same products at an orthopedic clinic during February 15–August 30, 2018, also for other than hematopoietic or immunologic reconstitution. Cultures of unopened products from the clinic by a Florida hospital identified contamination with *E. coli* and *E. faecalis*. In response, on September 28, Liveyon issued a voluntary recall and immediately discontinued purchase of the Genetech-processed stem cell products (*2*,*3*). On October 4, CDC issued a nationwide call for reports of culture-confirmed infections in patients who had received the Liveyon product.

As of December 14, CDC has received reports of infections in 12 patients from three states, including the initial Florida and Texas cases: Texas (seven), Florida (four), and Arizona (one). Infection types included bloodstream infections, joint infections, and epidural abscesses, among others. All 12 patients received infusions or injections of Liveyon's product before the recall. Among 11 patients for whom conditions prompting product administration were known, all had nonhematopoietic conditions such as pain or orthopedic conditions. All patients were hospitalized; none died (Table).

CDC tested unopened vials obtained from the Texas and Florida clinics where the initial patients had received the product. The six vials from Texas had the same cord-blood donor and processing date as those that had been administered to the patients with infections. *E. cloacae* was isolated from all six vials; *C. freundii* also was isolated from five. The four vials from Florida were from different donors and processing dates than were the vials from Texas. *E. coli* was isolated from one of two vials from the same cord-blood donor and processing date; *E.coli* and *E. faecalis* were isolated from one of two vials from two unique donors with unique processing dates.

Ongoing investigations include active case finding, additional laboratory testing to compare clinical and product isolates, onsite assessments of health care facility infection control and injection safety practices, and investigation of manufacturing practices (including distribution); initial investigation suggests that bacterial contamination occurred before distribution. Umbilical cord blood cannot be decontaminated after collection because there are currently no validated processes for sterilization, so manufacture of derived products must be highly controlled to prevent distribution of contaminated products (*4*). The Genetech-processed, Liveyon-distributed product is not FDA-approved or lawfully marketed. Though Genetech and Liveyon are registered with FDA, such registration is not a form of FDA approval. FDA registration alone does not demonstrate compliance of firms or their products with the law.

Regardless of when contamination occurred, this investigation highlights the serious potential risks to patients of stem cell therapies administered for unapproved and unproven uses other than hematopoietic or immunologic reconstitution (*5*). Although the safety and efficacy of stem cells for other than hematopoietic or immunologic reconstitution have not been well established (*1*,*4*), many companies, clinics, and clinicians continue to market products from various sources as treatment for orthopedic, neurologic, and rheumatologic conditions without FDA approval. Such clinics and providers operate in outpatient settings, which often have less robust oversight of infection control measures, including injection safety and medication preparation (*6*), potentially amplifying risk to patients. Therefore, FDA has recommended that patients avoid receiving such products outside controlled clinical studies being conducted under an investigational new drug application; these settings help ensure that appropriate manufacturing and safety reporting procedures are followed (*1*). Health care professionals and consumers should report any adverse events related to treatment with the Genetech/Liveyon products or any unapproved stem cell therapies to FDA's MedWatch Safety Information and Adverse Event Reporting Program (https://www.fda.gov/Safety/MedWatch/).

TABLE. Clinical characteristics of patients with culture-confirmed infections after receiving umbilical cord blood-derived stem cell products for other than hematopoietic or immunologic reconstitution — United States, 2018

Patient	Route/Site of administration	Date administered	Setting	Condition prompting product administration*	Specimen collection date, first positive culture	Organism isolated	Infection site	Days of initial hospitalization to treat infection
1	Intra-articular injection, knee and shoulder	Feb 15, 2018	Orthopedic clinic	Degenerative joint disease	Feb 21, 2018	*Escherichia coli, Proteus mirabilis*	Knee	15
2	Intra-articular injection, lumbar spine	Jun 13, 2018	Pain clinic	Pain	Jun 14, 2018	*Escherichia coli*	Bloodstream	4
3	Intra-articular injection, lumbar spine	Jul 27, 2018	Ambulatory surgery center	Pain	Aug 1, 2018	*Escherichia coli, Enterococcus faecalis*	Bloodstream, lumbosacral epidural abscess, discitis, and vertebral osteomyelitis†	58
4	Intra-articular injection, knee and shoulder	Aug 3, 2018	Orthopedic clinic	Unknown	Aug 10, 2018	*Escherichia coli, Enterococcus faecalis*	Knee	30
5	Intra-articular injection, shoulders	Aug 14, 2018	Chiropractic clinic	Osteoarthritis	Aug 29, 2018	*Escherichia coli*	Bloodstream, shoulders	8
6	Intra-articular injection, shoulder	Aug 22, 2018	Orthopedic clinic	Rotator cuff tear with intrasynovial cyst	Sep 9, 2018	*Escherichia coli*	Shoulder	6
7	Intra-articular injection, lumbar spine	Aug 28, 2018	Spine treatment clinic	Lumbar back pain	Sep 1, 2018	*Citrobacter koseri*	Bloodstream	6
8	Intra-articular injection, lumbar spine	Aug 29, 2018	Pain clinic	Pain	Sep 4, 2018	*Escherichia coli, Enterococcus faecalis*	Bloodstream	35
9	Intra-articular injection, knee	Aug 30, 2018	Orthopedic clinic	Osteoarthritis	Sep 7, 2018	*Escherichia coli, Enterococcus faecalis*	Knee	5
10	Intra-articular injection, cervical spine	Sep 12, 2018	Pain clinic	Pain	Sep 15, 2018	*Enterobacter cloacae, Citrobacter freundii*	Bloodstream, cellulitis at injection site§	9
11	Intra-articular injection, cervical and lumbar spine	Sep 12, 2018	Pain clinic	Pain (history of rheumatoid arthritis)	Sep 16, 2018	*Enterobacter cloacae, Citrobacter freundii*	Bloodstream	12
12	Intra-articular injection, lumbar spine and index fingers; intravenous infusion	Sep 12, 2018	Pain clinic	Pain, rheumatoid arthritis, osteoarthritis	Sep 16, 2018	*Enterobacter cloacae*	Bloodstream, lumbar epidural abscess	12

* As reported to CDC by health departments.
† Abscess and vertebrae were not cultured; both organisms were isolated from blood, and *E. faecalis* only was isolated from disc space.
§ No organisms were isolated from skin; both organisms were isolated from blood.

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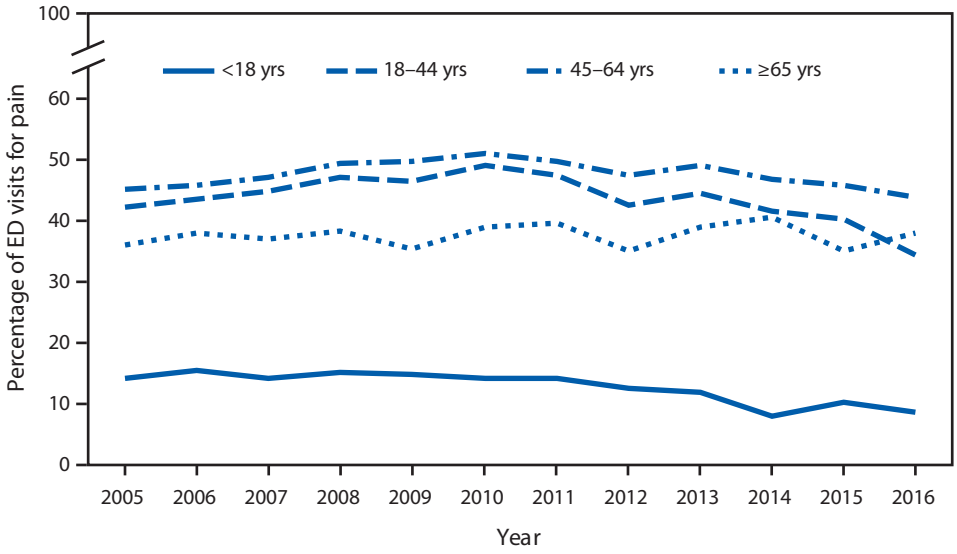
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Emergency Department (ED) Visits for Pain* at Which Opioids† Were Given or Prescribed, by Patient Age and Year — National Hospital Ambulatory Medical Care Survey, 2005–2016



* Based on a sample of visits to EDs in noninstitutional general and short-stay hospitals, exclusive of federal, military, and Veterans Administration hospitals, located in the 50 states and the District of Columbia. Pain-related visits were defined using up to three reasons for visit coded according to the National Center for Health Statistics Reason for Visit Classification (https://www.cdc.gov/nchs/data/series/sr_02/sr02_078.pdf) and grouped using an algorithm (https://jamanetwork.com/journals/jama/fullarticle/1149438).

† Visits in which at least one opioid was given in the ED or prescribed at discharge were analyzed. Opioids were defined using the Cerner Multum (https://www.cerner.com/solutions/drug-database) third level therapeutic category codes for narcotic analgesics (60) and narcotic analgesic combinations (191). Visits with only buprenorphine or buprenorphine-naloxone given or prescribed were not included.

The percentage of ED visits for pain with an opioid given or prescribed for those aged <18 years was stable from 2005 to 2011 but decreased from 2011 to 2016 from 14.3% to 8.5%. Among those aged 18–44 years and 45–64 years, the percentage increased from 2005 to 2010 but then decreased from 2010 to 2016. There was no significant change in opioid prescribing for visits for pain by adults aged ≥65 years, with 38.1% of visits including an opioid in 2016. The percentage of ED visits for pain with an opioid was lower for visits by children compared with adults, with adults aged 45–64 years having the highest percentage (43.8%) in 2016.

Source: National Center for Health Statistics. National Hospital Ambulatory Medical Care Survey, 2005–2016. https://www.cdc.gov/nchs/ahcd/ahcd_questionnaires.htm.

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For more information on this topic, CDC recommends the following link: https://www.cdc.gov/drugoverdose/providers/index.html.

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