Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

Weekly / Vol. 69 / No. 48

December 4, 2020

Sex Differences in HIV Testing — 20 PEPFAR-Supported Sub-Saharan African Countries, 2019

Bakary Drammeh, DrPH[1]; Amy Medley, PhD[1]; Helen Dale, BVSc, MBChB[1]; Anindya K. De, PhD[1]; Shane Diekman, PhD[1]; Randy Yee, MSc[1]; Tiffiany Aholou, PhD[1]; Arielle Lasry, PhD[1]; Andrew Auld, MD[2]; Brittney Baack, MPH[2]; Wayne Duffus, MD, PhD[1]; Ebrahim Shahul, MD[1]; Vincent Wong, MSc[3]; Michael Grillo, PhD[4]; Teeb Al-Samarrai, MD[5]; Shabeen Ally, PhD[5]; Mtemwa Nyangulu, MCHD[2]; Rose Nyirenda, MD[6]; Jacobus Olivier, PhD[7]; Thato Chidarikire, PhD[8]; Nompumelelo Khanyile, MBA[9]; Alick A. Kayange, MD[10]; Oscar Ernest Rwabiyago, MD[11]; Upendo Kategile, MSc[12]; Jema Bisimba, MPH[12]; Rachel A. Weber, PhD[13]; Gertrude Ncube, MPH[14]; Onesimo Maguwu, MPH[15]; Ismelda Pietersen, MPH[16]; Denis Mali, MD[17]; Edington Dzinotyiweyi, MA[18]; Lisa Nelson, MD[19]; Matovu John Bosco, MPH[20]; Kwarisiima Dalsone, MD[21]; Madina Apolot, MSc[19]; Samson Anangwe, MSc[22]; Leonard K. Soo, MPH[23]; Mary Mugambi, MD[24]; Andre Mbayiha, MD[25]; Placidie Mugwaneza, MPH[26]; Samuel S. Malamba, PhD[27]; Arlene Phiri, MCD[28]; Tina Chisenga, MD[29]; Mary Boyd, MD[30]; Chanie Temesgan, MD[31]; Mesfin Shimelis, MD[31]; Teklu Weldegebreal, MD[32]; Mirtie Getachew, MPH[33]; Shirish Balachandra, MD[34]; Ehui Eboi, PhD[35]; Willibord Shasha, MD[36]; Nicole Doumatey, MSc[34]; Didier Adjoua, MD[37]; Chidozie Meribe, MD[38]; Jerry Gwamna, MD[38]; Pamela Gado, MPH[39]; Ima John-Dada, MSc[40] ; Elie Mukinda, MD[41]; Luc F. Kamanga Lukusa, MD[42]; Lucien Kalenga, MD[43]; Sudhir Bunga, MD[44]; Victoria Achyut, MD[45]; John Mondi, MSc[44]; Peter Loeto, MSc[46]; Goabaone Mogomotsi, MPH[47]; Jenny Ledikwe, PhD[48]; Puleng Ramphalla, MSc[49]; Mphotleng Tlhomola, MSc[50]; Justine K. Mirembe, MBA[51]; Tse Nkwoh, MPH[52]; Laura Eno, MSc[52]; Leonard Bonono, MSc[53]; Nely Honwana, MA[54]; Noela Chicuecue, MD[55]; Ana Simbine MSc[56]; Inacio Malimane, MD[54]; Lenhle Dube, BSc[57]; Munamato Mirira, MSc[58]; Phumzile Mndzebele, MPH[59]; Alean Frawley, DO[60]; Yolanda Marina Rebello Cardo, MSc[60]; Stephanie Behel, MPH[1]

Despite progress toward controlling the human immunodeficiency virus (HIV) epidemic, testing gaps remain, particularly among men and young persons in sub-Saharan Africa (*1*). This observational study used routinely collected programmatic data from 20 African countries reported to the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) from October 2018 to September 2019 to assess HIV testing coverage and case finding among adults (defined as persons aged ≥15 years). Indicators included number of HIV tests conducted, number of HIV-positive test results, and percentage positivity rate. Overall, the majority of countries reported higher HIV case finding among women than among men. However, a slightly higher percentage positivity was recorded among men (4.7%) than among women (4.1%). Provider-initiated counseling and testing (PITC) in health facilities identified approximately two thirds of all new cases, but index testing had the highest percentage positivity in all countries among both sexes. Yields from voluntary counseling and testing (VCT) and mobile testing varied by sex and by country. These findings highlight the need to identify and implement the most efficient strategies for HIV case finding in these countries to close coverage

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

INSIDE

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

gaps. Strategies might need to be tailored for men who remain underrepresented in the majority of HIV testing programs.

In 2014, the Joint United Nations Programme on AIDS (UNAIDS) launched its 90–90–90 strategy for ending the global HIV pandemic: 90% of all persons living with HIV/AIDS (PLHIV) know their status; of these, 90% are receiving antiretroviral treatment (ART); and of these, 90% are virally suppressed (*2*). PEPFAR provides guidance on reaching these targets to all its supported countries (*3*). PEPFAR also collects data on standardized indicators as part of its Monitoring, Evaluation, and Reporting system (*4*). These data are collected by facility and community sites and are reported quarterly by each country program.

Routine program data reported to PEPFAR from October 2018 to September 2019 from 20 sub-Saharan African countries and modeling data from UNAIDS were used to identify progress toward achieving the first of the three 90–90–90 goals. These countries were selected because they collectively represent the highest HIV prevalence among PEPFAR-supported countries. Indicators used included the number of HIV tests conducted among adults, the number of HIV-positive test results, and yield (or percentage positivity) defined as the number of positive test results divided by the total number of tests reported. Results for each country are presented overall and disaggregated by sex and testing strategy. Testing strategies include index testing (offering an HIV test to the partners and biologic children of PLHIV), PITC (providers recommending an HIV test as part of routine care), VCT (HIV testing at a clinic dedicated to this purpose), and mobile testing (HIV testing offered at an ad hoc location in the community [e.g., van, workplace, or school]). The standard test statistic for the difference in proportions between men and women was computed on the basis of pooled variance formulation. P-values <0.05 were considered statistically significant for each pairwise difference and were computed under the asymptomatic normality assumption (*5*). PITC was used as the reference strategy for comparisons among strategies because the highest number of new HIV cases are identified by PITC in sub-Saharan Africa (*1*). The percentage positivity for the three other strategies (index testing, VCT, and mobile testing) was compared with PITC for each country and by sex.

From October 2018 to September 2019, PEPFAR supported 60,945,355 tests that identified 2,603,560 adults with positive HIV test results (5.0% yield; Table 1). Approximately one fifth (19.9%) of all testing occurred in South Africa. More women received tests than men (women, 40,263,510; men, 20,681,845). However, yield was slightly higher among men (970,100; 4.7% yield) than among women (1,633,460; 4.1% yield). Over one half (51.6%) of all HIV-positive results among men were reported by South Africa, Tanzania, and Zambia, and approximately one third (29.2%) were reported by South Africa alone.

Across the 19 countries (excluding Malawi because of limited data), PITC identified the most PLHIV (63.2%) compared with index testing (17.4%), VCT (11.0%), and mobile testing (8.4%). HIV case finding among men followed a similar

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2020;69:[inclusive page numbers].

TABLE 1. Adult human immunodeficiency virus (HIV) prevalence, by sex — 20 PEPFAR-supported African countries, October 2018–September 2019*

	HIV tests conducted			HIV tests positive		
		No.			No. (%)	
Country	**All**	**Men**	**Women**	**All**	**Men**	**Women**
Rwanda	888,336	371,405	516,931	7,343 (0.8)	2,929 (0.8)	4,414 (0.9)
Eswatini	305,714	106,448	199,266	21,341 (7.0)	8,697 (8.2)	12,644 (6.3)
Botswana	278,908	119,530	159,378	14,407 (5.2)	6,105 (5.1)	8,302 (5.2)
Namibia	398,722	130,566	268,156	14,078 (3.5)	5,385 (4.1)	8,693 (3.2)
Malawi	3,741,494	1,362,235	2,379,259	122,509 (3.3)	52,870 (3.9)	69,639 (2.9)
South Africa	12,131,042	3,996,848	8,134,194	759,465 (6.3)	267,255 (6.7)	492,210 (6.1)
Zimbabwe	2,059,970	709,379	1,350,591	112,605 (5.5)	43,340 (6.1)	69,265 (5.1)
Kenya	9,325,119	3,248,359	6,076,760	168,809 (1.8)	60,515 (1.9)	108,294 (1.8)
Zambia	4,666,548	1,843,640	2,822,908	275,966 (5.9)	111,599 (6.1)	164,367 (5.8)
Lesotho	739,505	247,653	491,852	28,899 (3.9)	11,453 (4.6)	17,446 (3.5)
Uganda	4,872,644	1,858,346	3,014,298	161,742 (3.3)	60,855 (3.3)	100,887 (3.3)
Ethiopia	401,572	153,500	248,072	8,729 (2.2)	3,543 (2.3)	5,186 (2.1)
Tanzania	6,930,758	2,415,017	4,515,741	314,364 (4.5)	121,603 (5.0)	192,761 (4.3)
Cameroon	839,762	317,881	521,881	32,435 (3.9)	11,648 (3.7)	20,787 (4.0)
Mozambique	5,651,254	1,519,954	4,131,300	281,022 (5.0)	103,433 (6.8)	177,589 (4.3)
Nigeria	4,309,213	1,348,056	2,961,157	158,351(3.7)	55,834 (4.1)	102,517 (3.5)
Côte d'Ivoire	2,200,382	564,945	1,635,437	60,058 (2.7)	19,713 (3.5)	40,345 (2.5)
DRC	811,233	235,984	575,249	41,898 (5.2)	16,062 (6.8)	25,836 (4.5)
Angola	141,292	49,215	92,077	9,208 (6.5)	3,253 (6.6)	5,955 (6.5)
South Sudan	251,887	82,884	169,003	10,331 (4.1)	4,008 (4.8)	6,323 (3.7)
Total	**60,945,355**	**20,681,845**	**40,263,510**	**2,603,560 (5.0)**	**970,100 (4.7)**	**1,633,460 (4.1)**

Source: PEPFAR Monitoring, Evaluation, and Reporting data for Accountability, Transparency, and Impact Monitoring database, October 2018–September 2019.
Abbreviations: DRC = Democratic Republic of Congo; PEPFAR = U.S. President's Emergency Plan for AIDS Relief.
* Nine of the 20 countries account for 90% of HIV prevalence: Kenya, Malawi, Mozambique, Nigeria, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. Six countries have achieved the first 90 target (Botswana, Eswatini, Kenya, Lesotho, Namibia, and South Africa), and knowledge of HIV status is <70% in Angola (69%), DRC (49%), and South Sudan (24%).

pattern: PITC identified 57.7% of HIV-positive men, followed by index testing (21.4%), VCT (11.9%), and mobile testing (9.0%). Six countries accounted for 80.2% of HIV-positive men identified through PITC: South Africa (220,940), Mozambique (56,960), Tanzania (52,574), Zambia (38,991), Kenya, (28,814), and Uganda (26,421). Additional data for new HIV cases identified across the four HIV testing strategies both overall and by sex are provided (Table 2).

Although PITC identified more PLHIV than any other testing strategy, the percentage positivity of index testing was higher than PITC in all countries and for both sexes (Table 3).The number of PLHIV identified through index testing ranged from 500 in South Sudan (11.0% yield) to 116,500 in Tanzania (21.4% yield) (Table 2). The five countries that identified the most PLHIV through index testing were Uganda (34,585), Mozambique (40,681), Kenya (51,717), Zambia (63,587), and Tanzania (116,546), and yields varied from 17.6% (Kenya) to 28.6% (Zambia). These countries also accounted for two thirds (69.7%) of all HIV-positive men identified through index testing: Uganda (15,313), Mozambique (19,064), Kenya (22,259), Zambia (28,383), and Tanzania (52,040). The contribution of index testing to the total number of HIV-positive men identified in these five countries ranged from 18.1% (Mozambique) to 42.8% (Tanzania).

The yield for VCT among men was significantly higher than for PITC in eight countries (Angola, Cameroon, Côte d'Ivoire, Malawi, Mozambique, Uganda, Zambia, and Zimbabwe) but was lower in the Democratic Republic of Congo (DRC) (Table 3). Similarly, mobile testing had a significantly higher yield than PITC among men in Cameroon, Côte d'Ivoire, DRC, Malawi, Mozambique, Nigeria, Uganda, and Zimbabwe but a lower yield in Botswana, Lesotho, and South Africa. Among women, VCT had a significantly higher yield than PITC in all countries except Botswana, whereas mobile testing had a significantly higher yield than PITC in all but three countries (Botswana, South Africa, and Kenya).

These findings will help guide the Ministries of Health in selecting specific testing strategies to increase HIV-testing coverage. This will help identify persons living with HIV infection.

Discussion

PITC identified the largest number of PLHIV, but index testing was more efficient at finding PLHIV as evidenced by a higher positivity rate. Several factors, including the absolute number of PLHIV identified, testing yield, cost per diagnosis, and the ability to reach persons with undiagnosed HIV infection, can help identify the best HIV-testing approach (*1*).

Although an efficient testing strategy in terms of identifying PLHIV, index testing is resource-intensive (*1*). For large yields

TABLE 2. Number and percentage of human immunodeficiency virus (HIV)–positive adults Identified by four HIV-testing strategies, overall and by sex — 20 PEPFAR-supported countries, October 2018–September 2019*

Country	Index testing			Provider-initiated testing			Voluntary counseling and testing			Mobile testing		
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
	No./Total no.[†] (%)[§]	% Positive	% Positive	No./Total no. (%)	% Positive	% Positive	No./Total no. (%)	% Positive	% Positive	No./Total no. (%)	% Positive	% Positive
Rwanda	1.4/26.6 (5.1)	4.6	5.8	2.4/545.9 (0.5)	0.5	0.4	2.6/259.9 (1.0)	0.8	1.2	0.9/55.9 (1.7)	1.0	2.8
Eswatini	3.5/13.9 (25.5)	25.6	25.4	11.7/214.9 (5.5)	6.6	5.0[¶]	4.0/46.6 (8.5)	7.9	9.1	2.1/30.3 (6.9)	6.5	7.2
Botswana	2.3/16.9 (13.8)	14.6	12.9	9.8/187.5 (5.3)	5.2	5.3	0.5/17.3 (3.0)	2.6	3.3	1.7/57.1 (3.0)	2.6	3.4
Namibia**	2.6/16.8 (15.6)	15.7	15.5	10.1/347.8 (2.9)	3.3	2.7	1.3/32.6 (3.9)	3.8	4.0	0.07/1.5 (4.5)	4.4	4.6
Malawi[††]	8.9/29.8 (30.1)	30.5	29.6	29.7/1,025.5 (2.9)	3.4	2.7[¶]	17.5/317.5 (5.5)	4.9	6.1[¶]	5.6/63.5 (8.9)	7.5	11.1[¶]
South Africa	28.5/92.4 (30.9)	30.0	31.7[¶]	647.8/10.2 (6.3)	6.9	6.0[¶]	2.2/26.3 (8.3)	7.3	11.2[¶]	80.9/1,747.6 (4.6)	4.2	4.9[¶]
Zimbabwe	23.8/73.8 (32.2)	34.5	30.2[¶]	79.6/1,904.1 (4.2)	4.4	4.1	5.0/45.5 (11.1)	9.7	11.9	4.2/36.6 (11.5)	9.4	13.5[¶]
Kenya	51.7/294.4 (17.6)	14.5	21.0[¶]	91.7/7,379.6 (1.2)	1.2	1.2	23.7/1,361.9 (1.7)	1.4	2.0[¶]	1.8/289.1 (0.6)	0.4	0.7
Zambia	63.6/222.2 (28.6)	26.4	30.7[¶]	105.1/2,884.3 (3.6)	3.8	3.6	87.3/1,455.2 (6.0)	5.6	6.3[¶]	19.9/104.8 (19.0)	15.7	22.0[¶]
Lesotho	4.2/17.3 (24.3)	25.4	23.3	20.2/597.0 (3.4)	4.3	3.0[¶]	0.4/7.8 (4.8)	3.3	5.7	4.1/117.4 (3.5)	2.7	4.5[¶]
Uganda	34.6/189.8 (18.2)	16.1	20.4[¶]	80.3/3,231.7 (2.5)	2.4	2.5	33.9/1,070.8 (3.2)	2.9	3.4	12.9/380.4 (3.4)	3.1	3.7
Ethiopia	2.8/26.1 (10.8)	10.5	11.1	4.3/313.6 (1.4)	1.5	1.3	0.9/40.8 (2.3)	1.8	2.4	0.7/21.0 (3.2)	2.5	3.9
Tanzania	116.5/544.0 (21.4)	19.9	22.9[¶]	153.9/5,192.5 (3.0)	3.2	2.9[¶]	5.0/103.5 (4.9)	3.8	5.8[¶]	38.9/1,090.6 (3.6)	3.4	3.7
Cameroon	5.3/46.3 (11.5)	9.5	14.3[¶]	21.4/708.1 (3.0)	2.8	3.1	4.5/66.2 (6.9)	5.1	8.3[¶]	1.1/19.1 (5.8)	4.5	7.0
Mozambique	40.7/151.3 (26.9)	24.9	28.9[¶]	177.4/4,540.9 (3.9)	5.7	3.4[¶]	54.3/863.6 (6.3)	6.1	6.4	8.6/95.5 (9.0)	7.2	11.6[¶]
Nigeria	25.1/103.5 (24.3)	19.5	30.6[¶]	79.4/3,007.8 (2.6)	3.2	2.4[¶]	38.1/947.0 (4.0)	3.3	4.6[¶]	15.8/250.9 (6.3)	6.1	6.4
Côte d'Ivoire	14.1/88.2 (16.0)	12.4	20.7[¶]	39.5/1,983.5 (2.0)	2.4	1.9[¶]	0.3/5.2 (6.6)	5.9	7.4	6.1/123.4 (4.9)	4.2	5.5
DRC	9.3/29.7 (31.4)	30.4	32.6	23.8/656.3 (3.6)	5.1	3.2[¶]	1.7/37.1 (4.6)	3.1	7.1[¶]	7.0/88.1 (8.0)	6.3	9.4[¶]
Angola	0.7/2.0 (37.3)	29.8	44.3[¶]	3.7/83.3 (4.5)	5.0	4.2	3.5/32.7 (10.8)	8.5	13.2[¶]	1.2/23.2 (5.2)	4.5	5.4
South Sudan	0.5/4.9 (11.0)	11.4	10.7	6.1/186.4 (3.3)	4.5	2.8[¶]	2.9/48.9 (6.0)	5.1	6.9	0.7/11.7 (6.4)	4.1	8.7
Total	**440.5/ 1,990.0 (22.1)**	**20.1**	**24.3[¶]**	**1,598.2/ 45,255.4 (3.5)**	**3.9**	**2.7[¶]**	**289.7/ 6,786.8 (4.3)**	**3.8**	**4.6[¶]**	**214.4/ 4,607.9 (4.7)**	**4.2**	**5.0[¶]**

Source: PEPFAR Monitoring, Evaluation, and Reporting data for Accountability, Transparency, and Impact Monitoring database, October 2018–September 2019.
Abbreviations: DRC = Democratic Republic of Congo; PEPFAR = U.S. President's Emergency Plan for AIDS Relief.
* Breakdown by strategy for 19 countries (excluding Malawi because of limited data).
† Number of HIV tests positive divided by the number of HIV tests conducted. Numbers are reported in thousands with one decimal place.
§ % indicates percent yield.
¶ Statistically significant difference between men and women at p-value <0.05. The p-values were calculated based on z-tests for differences in binomial proportions with pooled variance.
** Community index testing program yield of 22.6% overall across adults.
†† Data are from 5.5 districts (N = 28) in Malawi.

of persons with a new HIV diagnosis to be identified, index testing requires a massive, potentially expensive, scale-up (*6*). However, Kenya, Tanzania, Mozambique, and Uganda have achieved substantial scale-up, demonstrating the feasibility of index testing in sub-Saharan Africa. Although the majority of PLHIV in sub-Saharan Africa receive their diagnosis through PITC, findings from this analysis show that index testing is identifying new PLHIV in many countries.

Screening tools that use a combination of clinical and behavioral questions to identify persons most likely to be HIV-positive can increase the percentage positivity of PITC. However, these screening tools must be validated to ensure high sensitivity and good specificity to avoid missed opportunities for diagnosis (*3*).

These findings show that men are less likely to be tested for HIV than women and represented 37% of HIV-positive results. Although women were twice as likely to be tested for HIV, approximately one third of new cases identified occurred among men. In all countries, women are routinely tested for HIV as part of antenatal testing, regardless of their clinical or behavioral risk factors. This might help explain why the number of tests conducted was higher among women compared with men, but the percent positivity rate was lower. PITC and index testing identified the most HIV-positive men, but mobile testing remains an important strategy to reach men who are unable or unwilling to attend health care facilities. Interventions that might improve coverage among men include flexible hours, male counselors, and integration of HIV testing into screening for other chronic conditions (*7*). Although not included in this analysis, HIV self-testing, directly offered within health facilities (*8*) or distributed by sex or needle-sharing partners as part of index testing (*9*), might also be an efficient method for reaching men.

The findings in this report are subject to at least three limitations. First, cost data are lacking. Second, data quality varies across countries despite PEPFAR's monitoring and reporting guidance. Finally, PITC data include antenatal testing, which results in more testing among women. Testing antenatal women at lower risk also explains why the yield for PITC is lower for women than men, even though the yield is higher

TABLE 3. Percentage positivity of four human immunodeficiency virus (HIV) testing strategies in identifying new HIV-positive adults, stratified by sex — 20 PEPFAR-supported countries, October 2018–September 2019*

	% Yield							
	Men				Women			
Country	PITC as reference*	Index testing†	VCT§	Mobile testing¶	PITC as reference	Index testing	VCT	Mobile testing
Rwanda	0.5	4.6**	0.8	1.0	0.4	5.8**	1.2	2.8**
Eswatini	6.6	25.6**	7.9	6.5	5.0	25.4**	9.1**	7.2**
Botswana	5.2	14.6**	2.6	2.6**	5.3	12.9**	3.3	3.4
Namibia	3.3	15.7**	3.8	4.4	2.7	15.5**	4.0	4.6
Malawi	3.4	30.5**	4.9**	7.6**	2.7	29.6**	6.1**	11.1**
South Africa	6.9	30.0**	7.3	4.2**	6.0	31.7**	11.2**	4.9**
Zimbabwe	4.4	34.5**	9.7**	9.4**	4.1	30.2**	11.9**	13.5**
Kenya	1.2	14.5**	1.4	0.4	1.2	21.0**	2.0**	0.7
Zambia	3.8	26.4**	5.6**	15.7**	3.6	30.7**	6.3**	22.0**
Lesotho	4.3	25.4**	3.3	2.7**	3.0	23.3**	5.7	4.5**
Uganda	2.4	16.1**	2.9**	3.1**	2.5	20.4**	3.4**	3.7**
Ethiopia	1.5	10.5**	1.8	2.5	1.3	11.1**	2.4	3.9**
Tanzania	3.2	19.9**	3.8	3.4	2.9	22.9**	5.8**	3.7**
Cameroon	2.8	9.5**	5.1**	4.5	3.1	14.3**	8.3**	7.0**
Mozambique	5.7	24.9**	6.1	7.2**	3.4	28.9**	6.4**	11.6**
Nigeria	3.2	19.5**	3.3	6.1**	2.4	30.6**	4.6**	6.4**
Côte d'Ivoire	2.4	12.4**	5.9**	4.2**	1.9	20.7**	7.4**	5.5**
DRC	5.1	30.4**	3.1	6.3	3.2	32.6**	7.1**	9.4**
Angola	5.0	29.8**	8.5**	4.5	4.2	44.3**	13.2**	5.4
South Sudan	4.5	11.4**	5.1	4.1	2.8	10.7**	6.9**	8.7**

Source: PEPFAR Monitoring, Evaluation, and Reporting data for Accountability, Transparency, and Impact Monitoring database, October 2018–September 2019.
Abbreviations: DRC = Democratic Republic of Congo; PEPFAR = U.S. President's Emergency Plan for AIDS Relief; PITC = provider-initiated testing and counseling; VCT = voluntary counseling and testing.
* PITC for HIV testing of persons at health facilities.
† Index testing of persons with new HIV diagnoses.
§ VCT to determine HIV status.
¶ Mobile testing outside health facilities.
** Statistically significant differences between PITC as reference compared with other strategies at p-values <0.05. The p-values were calculated on the basis of z-tests for differences in binomial proportions with pooled variance.

for women with the other three testing strategies. Strengths include the number of countries involved in the analysis and the volume of testing data collected by implementing partners.

As more PLHIV are identified, finding the remaining PLHIV will become more difficult and expensive because new cases will be harder to find. Multiple testing strategies, tailored to the epidemiologic context and targeted to populations with low access to HIV testing, can help reach these persons. Recency testing now allows programs to identify persons infected with HIV in the past year as well as clusters of incident cases. Immediate and intensified index testing efforts targeted to these clusters might reduce transmission and help countries achieve epidemic control (*10*).

Corresponding author: Bakary Drammeh, bdrammeh@cdc.gov, 404-718-8604.

[1]Division of Global HIV & TB, Center for Global Health, CDC; [2]Division

Summary

What is already known on this topic?

Identifying persons with HIV infection and initiating treatment are critical to ending the HIV epidemic by 2030. Despite global progress, testing gaps remain, particularly for men.

What is added by this report?

From October 2018 to September 2019, men in 20 sub-Saharan African countries were half as likely as women to receive an HIV test, and 37% of the HIV-positive results were among men. Similar sex differences were observed across HIV testing strategies based upon percent positivity rates.

What are the implications for public health practice?

These results highlight provider-initiated testing and index testing as strategies that might improve HIV testing coverage and maximize the number of persons newly identified as HIV-positive in 20 African countries.

of Global HIV & TB, Center for Global Health, CDC Malawi; [3]US Agency for International Development, Office of HIV/AIDS, Washington, DC; [4]US Department of Defense, HIV/AIDS Prevention Program; [5]Office of the US Global AIDS Coordinator and Health Diplomacy, US Department of State; [6]Ministry of Health, Malawi; [7]Division of Global HIV & TB, Center for Global Health, CDC South Africa; [8]HIV Prevention Programmes, National Department of Health, Ministry of Health, South Africa; [9]US Agency for International Development, South Africa; [10]US Department of Defense, HIV/AIDS Program, Tanzania; [11]Division of Global HIV & TB, Center for Global Health, CDC Tanzania; [12]US Agency for International Development, Tanzania; [13]Division of Global HIV & TB, Center for Global Health, CDC Zimbabwe; [14]Ministry of Health, Zimbabwe; [15]US Agency for International Development, Zimbabwe; [16]Division of Global HIV & TB, Center for Global Health, CDC Namibia; [17]US Agency for International Development, Namibia; [18]Ministry of Health and Social Services, Namibia; [19]Division of Global HIV & TB, Center for Global Health, CDC Uganda; [20]Ministry of Health, Uganda; [21]US Agency for International Development Uganda; [22]Department of Defence, Kenya; [23]US Agency for International Development, Kenya; [24]Ministry of Health, Kenya; [25]Division of Global HIV & TB, Center for Global Health, CDC Rwanda; [26] Ministry of Health, Rwanda; [27]Division of Global HIV & TB, Center for Global Health, CDC Rwanda; [28]US Agency for International Development, Zambia; [29]Ministry of Health, Zambia; [30]Division of Global HIV & TB, Center for Global Health, CDC Zambia; [31]Division of Global HIV & TB, Center for Global Health, CDC Ethiopia; [32]US Agency for International Development, Ethiopia; [33]Federal Ministry of Health, Ethiopia; [34]Division of Global HIV & TB, Center for Global Health, CDC Côte D'Ivoire; [35]Ministry of Health, Côte D'Ivoire; [36]US Agency for International Development, Côte D'Ivoire; [37]Department of Defense, Côte D'Ivoire; [38]Division of Global HIV & TB, Center for Global Health, CDC Nigeria; [39]US Agency for International Development, Nigeria; [40]Federal Ministry of Health, Nigeria; [41]Division of Global HIV & TB, Center for Global Health, CDC Democratic Republic of Congo; [42]Ministry of Health, Democratic Republic of Congo; [43]US Agency for International Development, Democratic Republic of Congo; [44]Division of Global HIV & TB, Center for Global Health, CDC South Sudan; [45]Ministry of Health, South Sudan; [46]Division of Global HIV & TB, Center for Global Health, CDC Botswana; [47]Ministry of Health, Botswana; [48]International Training and Education Center, Botswana; [49]Division of Global HIV & TB, Center for Global Health, CDC Lesotho; [50]Ministry of Health, Lesotho; [51]US Agency for International Development, Lesotho; [52]Division of Global HIV & TB, Center for Global Health, CDC Cameroon; [53]Ministry of Health, Cameroon; [54]Division of Global HIV & TB, Center for Global Health, CDC Mozambique; [55]Ministry of Health, Mozambique; [56]US Agency for International Development, Mozambique; [57]Ministry of Health, Eswatini; [58]US Agency for International Development, Eswatini; [59]Division of Global HIV & TB, Center for Global Health, CDC Eswatini; [60]Division of Global HIV & TB, Center for Global Health, CDC Angola.

References

1. De Cock KM, Barker JL, Baggaley R, El Sadr WM. Where are the positives? HIV testing in sub-Saharan Africa in the era of test and treat. AIDS 2019;33:349–52. PMID:30557162 https://doi.org/10.1097/QAD.0000000000002096
2. Joint United Nations Programme on HIV/AIDS (UNAIDS). 90–90–90: an ambitious treatment target to help end the AIDS Epidemic. Geneva, Switzerland: UNAIDS; 2014. https://www.unaids.org/sites/default/files/media_asset/90-90-90_en.pdf
3. US President's Emergency Plan for AIDS Relief. PEPFAR 2020 country operational plan guidance for all PEPFAR countries. Washington, DC: US President's Emergency Plan for AIDS Relief; 2020. https://www.state.gov/wp-content/uploads/2020/01/COP20-Guidance_Final-1-15-2020.pdf
4. US President's Emergency Plan for AIDS Relief. Monitoring, evaluation, and reporting indicator reference guide, version 2.4. Washington, DC: US President's Emergency Plan for AIDS Relief; 2019. https://www.state.gov/wp-content/uploads/2019/10/PEPFAR-MER-Indicator-Reference-Guide-Version-2.4-FY20.pdf
5. Siegel and Castellan. Nonparametric statistics for the behavioral sciences. 2nd ed. New York, NY: McGraw-Hill; 1988.
6. Sharma M, Smith JA, Farquhar C, et al. Assisted partner notification services are cost-effective for decreasing HIV burden in western Kenya. AIDS 2018;32:233–41. PMID:29135576
7. Sharma M, Barnabas RV, Celum C. Community-based strategies to strengthen men's engagement in the HIV care cascade in sub-Saharan Africa. PLoS Med 2017;14:e1002262. PMID:28399122 https://doi.org/10.1371/journal.pmed.1002262
8. Dovel K, Shaba F, Offorjebe OA, et al. Effect of facility-based HIV self-testing on uptake of testing among outpatients in Malawi: a cluster-randomised trial. Lancet Glob Health 2020;8:e276–87. PMID:31981557 https://doi.org/10.1016/S2214-109X(19)30534-0
9. Choko AT, Corbett EL, Stallard N, et al. HIV self-testing alone or with additional interventions, including financial incentives, and linkage to care or prevention among male partners of antenatal care clinic attendees in Malawi: an adaptive multi-arm, multi-stage cluster randomised trial. PLoS Med 2019;16:e1002719. PMID:30601823 https://doi.org/10.1371/journal.pmed.1002719
10. Kim AA, Behel S, Northbrook S, Parekh BS. Tracking with recency assays to control the epidemic: real-time HIV surveillance and public health response. AIDS 2019;33:1527–9. PMID:31021850 https://doi.org/10.1097/QAD.0000000000002239

Multidisciplinary Community-Based Investigation of a COVID-19 Outbreak Among Marshallese and Hispanic/Latino Communities — Benton and Washington Counties, Arkansas, March–June 2020

Katherine E. Center, PhD[1]; Juliana Da Silva, MD[1]; Angela L. Hernandez, MD[1]; Kristyn Vang, MPH[2]; Daniel W. Martin, MSPH[1]; Jerry Mazurek, MD[1]; Emily A. Lilo, PhD[1]; Nichole K. Zimmerman, MS[1]; Elisabeth Krow-Lucal, PhD[1]; Ellsworth M. Campbell, MS[1]; Janet V. Cowins, PhD[1]; Chastity Walker, DrPH[1]; Kenneth L. Dominguez, MD[1]; Bill Gallo[1]; Jayleen K.L. Gunn, PhD[1]; Donald McCormick, MSHI[2]; Cassie Cochran, MPH[2]; Michelle R. Smith, PhD[2]; Jennifer A. Dillaha, MD[2]; Allison E. James, DVM, PhD[2,3]

By June 2020, Marshallese and Hispanic or Latino (Hispanic) persons in Benton and Washington counties of Arkansas had received a disproportionately high number of diagnoses of coronavirus disease 2019 (COVID-19). Despite representing approximately 19% of these counties' populations (*1*), Marshallese and Hispanic persons accounted for 64% of COVID-19 cases and 57% of COVID-19–associated deaths. Analyses of surveillance data, focus group discussions, and key-informant interviews were conducted to identify challenges and propose strategies for interrupting transmission of SARS-CoV-2, the virus that causes COVID-19. Challenges included limited native-language health messaging, high household occupancy, high employment rate in the poultry processing industry, mistrust of the medical system, and changing COVID-19 guidance. Reducing the COVID-19 incidence among communities that suffer disproportionately from COVID-19 requires strengthening the coordination of public health, health care, and community stakeholders to provide culturally and linguistically tailored public health education, community-based prevention activities, case management, care navigation, and service linkage.

All laboratory-confirmed COVID-19 cases in Benton and Washington counties in the Arkansas Department of Health (ADH) database reported during March 11–June 13, 2020, were included in these analyses. Community engagement was conducted during June 15–July 3, 2020, to identify challenges to interrupting SARS-CoV-2 transmission. Based on information from the community and ADH, all Native Hawaiian/Pacific Islander persons in Benton and Washington counties were considered Marshallese. Marshallese persons come from the Republic of the Marshall Islands, a sovereign nation and part of the Compact of Free Association. The Marshallese population has higher rates of some adverse health outcomes because of long-standing systemic factors, including poverty, poor access to care, and a nuclear bomb testing program during the Cold War (*2*).

Three focus groups with Marshallese community members (26 total participants) and three with Hispanic community members (30 total participants) were conducted to understand drivers of transmission and determine community-level perspectives and needs related to COVID-19. Separate focus groups including students, community members, and faith leaders were held online and in-person in English, Spanish, and Marshallese. Two churches and 21 businesses were visited across both counties, and key-informant interviews were conducted with Marshallese and Hispanic community leaders. Notes were taken during focus group discussions and key-informant interviews; next, two CDC team members reached consensus of the themes presented by the Hispanic and Marshallese communities independently. Themes were reviewed and brought to consensus with other team members present at the activity (Box). Quantitative analyses were conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

Among a total of 3,436 laboratory-confirmed COVID-19 cases in Benton and Washington counties during March 11–June 13, 647 (19%) occurred among Marshallese persons and 1,554 (45%) among Hispanic persons (Table). Incidences among Marshallese (8,390 per 100,000 persons) and Hispanic persons (1,795 per 100,000) were 71 and 15 times higher, respectively, than incidence among non-Hispanic White (White) persons (118 per 100,000). Approximately one half of COVID-19 cases occurred among males (48% in both groups), and the highest percentage of cases occurred among persons aged 25–44 years (Marshallese, 40%; Hispanic, 35%). Poultry processing† was the most frequently reported occupation among Marshallese (28%) and Hispanic (40%) persons with COVID-19. Overall, 181 (5%) COVID-19 patients were hospitalized across all groups. Compared with the rate of hospitalization in White persons (eight per 100,000), rates were higher among Marshallese persons (765 per 100,000) and Hispanic persons (87 per 100,000); mortality was also higher among Marshallese (130 per 100,000) and Hispanic persons (six per 100,000) than among White persons

* 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

† Nonpoultry work includes all other types of employment, e.g., food service, customer service, health care, construction, self-employed, teaching, and other factory or office work.

BOX. Themes* identified from six focus group discussions with Marshallese and Hispanic or Latino communities — Benton and Washington Counties, Arkansas, June 15–July 3, 2020†

Concern about family and community
- Confusion and anxiety about testing and getting results
- Actively involved in COVID-19 education, mitigation, and support services
- Assembled task forces and were tracking cases and deaths in their populations

Need for increased understanding and awareness about all aspects of prevention, testing, isolation, and treatment of COVID-19
- Inconsistent messages from authorities, reopening the state, and communication barriers led to miscommunications and misunderstandings
- Need more knowledge of health care systems, resources, and support services to access and navigate
- Need more translated communication and resources describing
  - Modes of transmission of COVID-19
  - How specific prevention behaviors decrease COVID-19 risk
  - Factors that increase risk for COVID-19–associated complications or death
  - Testing, including how to get results
  - When to seek emergency care
- Messaging needs to come from local sources in a variety of ways
- Messaging needs to be repeated

Actual and perceived barriers to testing, health care, and support services
- Lack of knowledge on availability of resources, both typical and COVID-19–specific
- Lack of knowledge or understanding on how to access resources that are available
- Language barriers
- Lack of primary health care (affects health as well as knowledge of available resources and how to access them)
- Avoidance of health care systems and reluctance to seek care (Marshallese only)

Barriers to social distancing
- Living in high-occupancy households
- Working jobs where they cannot isolate
- Financial constraints, lack resources or social safety nets (e.g., extended family is not nearby, lack of connections to the local community)

Abbreviation: COVID-19 = coronavirus disease 2019.
* All themes apply to both communities unless specified otherwise.
† The outbreak study period (March 11–June 13, 2020) preceded the community engagement study period (June 15–July 3, 2020).

(two per 100,000). A higher proportion of White persons with COVID-19 were aged ≥65 years (17%) compared with Marshallese or Hispanic persons with COVID-19 (5% aged ≥65 years). However, rates were not age-adjusted because of an absence of accurate population estimates by age for these counties. Analyses of addresses identified 79 households with four or more COVID-19 cases, totaling 390 cases, or 11% of all cases; 35% of persons in household clusters identified as Marshallese and 54% as Hispanic. In 30 (38%) of the 79 household clusters, the initial cases occurred in poultry workers; in the remaining 49 clusters, 18 (37%) included at least one poultry worker with COVID-19.

Focus group discussions and key-informant interviews revealed that although Marshallese and Hispanic persons were concerned about COVID-19, prevention and mitigation measures were not consistently implemented (Box). High-occupancy households were common in both communities, making quarantine and isolation difficult. Participants reported that staying home from work and seeking medical care were not economically viable. Both groups reported low utilization of medical care. Marshallese persons reported a strong distrust of and anxiety around Western medicine, especially hospitals. Hospital isolation policies and the limited availability of bilingual staff members increased anxiety, confusion, and mistrust.

TABLE. Characteristics of persons with laboratory-confirmed COVID-19, by race/ethnicity — Benton and Washington Counties, Arkansas, March 11–June 13, 2020*

	No. (%), [rate]†				
Characteristic	**Marshallese**	**Hispanic/Latino**	**White, non-Hispanic**	**Other, non-Hispanic**	**Total**
Population	7,712§ (2)	86,581 (17)	365,839 (72)	49,437 (10)	**509,569**
Laboratory-confirmed cases	647 (19) [8,390]	1,554 (45) [1,795]	432 (13) [118]	803 (23) [1,620]	**3,436 [670]**
Sex¶					
Female	331 (52)	811 (52)	214 (50)	371 (46)	**1,727 (51)**
Male	310 (48)	738 (48)	217 (50)	427 (54)	**1,692 (49)**
Age group (yrs)					
<18	165 (26)	275 (18)	34 (8)	174 (22)	**648 (19)**
18–24	74 (11)	194 (12)	51 (12)	103 (13)	**422 (12)**
25–44	260 (40)	545 (35)	159 (37)	307 (38)	**1,271 (37)**
45–64	118 (18)	464 (30)	115 (27)	179 (22)	**876 (25)**
≥65	30 (5)	76 (5)	73 (17)	40 (5)	**219 (6)**
Employment**					
Poultry work	152 (28)	574 (40)	57 (14)	137 (19)	**920 (30)**
Nonpoultry work††	111 (20)	570 (40)	194 (47)	72 (10)	**947 (31)**
Unemployed or retired	76 (14)	105 (7)	36 (9)	13 (2)	**230 (7)**
Unknown	211 (38)	183 (13)	124 (30)	483 (69)	**1,001 (32)**
Clinical course/outcome					
Hospitalized	59 (9) [765]	75 (5) [87]	30 (7) [8]	17 (2) [34]	**181 [36]**
Died	10 (2) [130]	5 (0) [6]	8 (2) [2]	3 (0) [6]	**26 [5]**

Abbreviation: COVID-19 = coronavirus disease 2019.
* The outbreak study period (March 11–June 13, 2020) preceded the community engagement study period (June 15–July 3, 2020).
† Cases per 100,000 population; rates reported for laboratory confirmed cases, hospitalizations, and deaths.
§ 2010 U.S. Census population estimate; this number is assumed to be an underestimate based on reports of school enrollment.
¶ Totals for sex do not sum to the total number of cases because of missing data.
** Totals for employment do not sum to the total number of cases because person aged ≤ 18 years were excluded.
†† Nonpoultry work includes all other types of employment (e.g., food service, customer service, health care, construction, self-employed, teaching, and other factory or office work).

Participants in both communities reported little awareness of public health messaging and low knowledge regarding SARS-CoV-2 transmission and disease characteristics. Participants also reported being unaware of or unsure about how to access support services available in the local community, leading to confusion around prevention, testing, and services. Participants reported that they typically received information from social networks and on social media. Changing COVID-19 guidance, especially related to reopening, decreased the sense of urgency and increased confusion around the need to continue prevention and mitigation practices. Business owners reported concerns about difficulty enforcing compliance with new guidance. Participants expressed confusion about the meaning and necessity of isolation and quarantine, the difference between the two, and what they needed to do to return to work.

Discussion

Marshallese and Hispanic communities in two Arkansas counties experienced disproportionate COVID-19–associated morbidity and mortality: COVID-19 incidence, hospitalization rate, and mortality among Marshallese persons were 71 times, 96 times, and 65 times higher, respectively, than rates among White persons. Similarly, COVID-19 incidence, hospitalization rate, and mortality among Hispanic persons were 15 times, 11 times, and three times higher, respectively, than rates among White persons. Disparities in COVID-19 outcomes are likely influenced by long-standing systemic inequities in social determinants of health that have left racial and ethnic minority populations with high rates of underlying conditions (*3*,*4*) and increased risk for COVID-19–associated illness and death (*5*,*6*). Racial and ethnic minority groups are more likely to work where physical distancing is not possible (*5*,*7*) and where COVID-19 incidence is high (*5*) such as within the poultry processing industry, which relies disproportionately on employees from racial and ethnic minority groups (*8*). In addition, high household occupancy is associated with both low income and COVID-19–associated deaths (*5*).

In the United States, low English fluency has been associated with high COVID-19 incidence (*5*,*6*,*9*). Marshallese and Hispanic persons reported a lack of native language information. In addition, Marshallese and Hispanic participants reported limited use of health care systems. Lack of native language messaging from trusted sources (peers, social media, and community and faith-based organizations) in their native languages, low familiarity with health care systems, and an urgent and evolving health crisis combined to create overall confusion regarding prevention, testing, treatment, and availability of support services. The Marshallese community also indicated high levels of preexisting medical mistrust. Current restrictions on hospital visitors, few Marshallese-speaking medical staff members, and an inconsistently available COVID-19 interpretation call-line compounded mistrust, resulting in delayed medical treatment for COVID-19.

To slow community transmission of SARS-CoV-2 in Marshallese and Hispanic communities a number of public health actions, based on focus group input, might increase community buy-in, utilization of health care services, and organizing efforts to slow the transmission of SARS-CoV-2, and decrease duplication of effort. Enhancing coordination of culturally and linguistically tailored outreach, health education, and support services to communities by public health, health care, and community stakeholders might improve the quality and timeliness of information and increase the number of trusted sources who share reliable public health information, leading to increased awareness of risks and adoption of recommended prevention behaviors. Accessible public health communication that does not rely on literacy (in English or native languages), with an emphasis on social media, testimonials, and short videos might increase effective use of information. Beneficial public health topics include factors that can increase or decrease COVID-19 risk and when emergency care should be sought. Also, community partners might be more aware of the social and cultural needs and concerns of the communities and can more closely monitor use of COVID-19 mitigation behaviors, health care, and support services for possible gaps. In addition, policies that allow for workers to miss work for testing, isolation, and quarantine are recommended.

The findings in this report are subject to at least five limitations. First, information regarding underlying medical conditions was incomplete; therefore, epidemiologic analysis in the context of general health status was not possible. Second, the age distribution for Marshallese and Hispanic persons with COVID-19 was younger than that for White persons with COVID-19; controlling for age would likely widen the disparities related to the adverse outcomes of hospitalization and death. Third, self-reported occupation might have led to misclassification of employment. Fourth, in clusters, the initial case was inferred from symptom onset date, specimen collection date, or case report date; therefore, true initial cases might be incorrectly identified. Finally, the Marshallese and Hispanic persons who participated in the focus groups and key-informant interviews might not be representative of their communities.

Communities that suffer disproportionately from COVID-19, especially those affected by long-standing inequities in social determinants of health, need culturally and linguistically tailored public health education, community-based prevention activities, case management, care navigation, and service linkage. Such assistance, paired with a strong coordination of stakeholders, should encourage community acceptance and adoption of prevention and mitigation methods and include opportunities for community feedback to ensure that messaging and services are reaching target populations.

Summary

What is already known about this topic?

Inequities in social determinants of health have put racial and ethnic minority groups at increased risk for COVID-19 and associated mortality.

What is added by this report?

Marshallese and Hispanic persons represented approximately 19% of the population but accounted for 64% of COVID-19 cases and 57% of associated deaths in two Arkansas counties. Contributing factors include lack of relevant health communications, limited coordination between stakeholders, mistrust of the medical system, financial need to work, and household density.

What are the implications for public health practice?

Reducing COVID-19 disparities requires strengthening the coordination of public health, health care, and community stakeholders to provide tailored health education, community-based prevention activities, case management, care navigation, and service linkage.

Corresponding author: Katherine E. Center, qbj1@cdc.gov.

[1]CDC COVID-19 Response Team; [2]Arkansas Department of Health; [3]Epidemic Intelligence Service, CDC.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Rodriguez-Diaz CE, Guilamo-Ramos V, Mena L, et al. Risk for COVID-19 infection and death among Latinos in the United States: examining heterogeneity in transmission dynamics. Ann Epidemiol 2020. Epub July 23, 2020. PMID:32711053 https://doi.org/10.1016/j.annepidem.2020.07.007
2. McElfish PA, Post J, Rowland B. A social ecological and community-engaged perspective for addressing health disparities among Marshallese in Arkansas. Int J Nurs Sci 2016;3:191. http://dx.doi.org/10.15344/2394-4978/2016/191
3. Subica, AM, Agarwal, N, Sullivan JG, Link BG. Obesity and associated health disparities among understudied multiracial, Pacific Islander, and American Indian adults. Obesity 2017;25:2128–36. https://doi.org/10.1002/oby.21954
4. Agency for Healthcare Research and Quality. 2018 National healthcare quality and disparities report. Rockville, MD: US Department of Health and Human Services, Agency for Healthcare Research and Quality; 2018. https://www.ahrq.gov/research/findings/nhqrdr/nhqdr18/index.html
5. Singu S, Acharya A, Challagundla K, Byrareddy SN. Impact of social determinants of health on the emerging COVID-19 pandemic in the United States. Front Public Health 2020;8:406. PMID:32793544 https://doi.org/10.3389/fpubh.2020.00406

6. Office of Disease Prevention and Health Promotion. Healthy people 2020. Rockville, MD: US Department of Health and Human Services, Office of Disease Prevention and Health Promotion; 2020. https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health
7. Waltenburg MA, Victoroff T, Rose CE, et al.; COVID-19 Response Team. Update: COVID-19 among workers in meat and poultry processing facilities—United States, April–May 2020. MMWR Morb Mortal Wkly Rep 2020;69:887–92. PMID:32644986 https://doi.org/10.15585/mmwr.mm6927e2
8. Office of Disease Prevention and Health Promotion. Healthy people 2030. Rockville, MD: US Department of Health and Human Services, Office of Disease Prevention and Health Promotion; 2020. https://health.gov/healthypeople
9. Census Bureau. 2018 American Community Survey 1-year estimates data profiles. Washington, DC: US Department of Commerce, Census Bureau; 2018. https://data.census.gov/cedsci/table?q=United%20States&g=0500000US05007,05143&y=2018&tid=ACSDP1Y2018.DP05&hidePreview=true

Disproportionate Incidence of COVID-19 Infection, Hospitalizations, and Deaths Among Persons Identifying as Hispanic or Latino — Denver, Colorado March–October 2020

Laura Jean Podewils, PhD[1,2,3]; Tori L. Burket, MS[1]; Christie Mettenbrink, MPH[1]; Abigail Steiner, MPH[1]; Allison Seidel, MPH[1]; Kenneth Scott, PhD[1]; Lilia Cervantes, MD[2,4,5]; Romana Hasnain-Wynia, PhD[2,5]

Persons identifying as Hispanic or Latino (Hispanic) represent the second largest racial/ethnic group in the United States (*1*), yet understanding of the impact of coronavirus disease 2019 (COVID-19) in this population is limited. To evaluate COVID-19 health disparities in the community and inform public health, health system, and community-based interventions, local public health authorities analyzed the sociodemographic characteristics of persons who were diagnosed, hospitalized, and who died with COVID-19 in Denver, Colorado. During the first 7 months of the COVID-19 epidemic in Denver (March 6–October 6, 2020) the majority of adult COVID-19 cases (54.8%), hospitalizations (62.1%), and deaths (51.2%) were among persons identifying as Hispanic, more than double the proportion of Hispanic adults in the Denver community (24.9%) (*1*). Systemic drivers that influence how Hispanic persons live and work increase their exposure risks: compared with non-Hispanic persons, Hispanic persons with COVID-19 in Denver reported larger household sizes and were more likely to report known exposures to household and close contacts with COVID-19, working in an essential industry, and working while ill. Reducing the disproportionate incidence of COVID-19 morbidity and mortality among Hispanic persons will require implementation of strategies that address upstream social and environmental factors that contribute to an increased risk for both infection and transmission and that facilitate improved access to culturally congruent care.

Staff members from Denver Public Health, a department of Denver Health and Hospital Authority (DHHA), conducted interviews or reviewed medical records for all persons with diagnosed laboratory-confirmed COVID-19 who resided in the city and county of Denver per notification of the Colorado Electronic Disease Reporting System* during March–October 2020. Interviews with persons whose primary language was Spanish were conducted in Spanish by bilingual interviewers or through the DHHA language line, which provides 24/7 access to professional interpreters for over 240 languages. Staff members gathered sociodemographic and epidemiologic information, including potential sources of exposure (e.g., household, close contact, and recent travel), signs and symptoms, symptom onset date, and whether the respondents worked while ill. In early May, the interview form was expanded to include detailed information on industry and occupation according to national guidelines (*2*) and household size. Because of the large volume of cases and difficulty reaching persons in the hospital, medical chart reviews, rather than telephone interviews, were used to obtain information about persons hospitalized or deceased at the time of COVID-19 diagnosis. Data from case interviews and medical chart reviews were obtained from standardized case report forms, validated for completeness, and entered into a secure REDCap database (*3*). The analysis used public health surveillance data and was carried out to understand and inform public health actions to control the spread of COVID-19 in the Denver community; the project was determined to be nonhuman subjects' research and exempt by the Colorado Multiple Institutional Review Board.

The analysis focused on adults aged ≥18 years living in noncongregate settings (excluding persons in long-term care facilities, jails, or in shelters for persons experiencing homelessness) at the time of diagnosis and aimed to identify COVID-19 health disparities in the community to inform public health, health system, and community-based interventions. The proportions of adults with laboratory-confirmed COVID-19, those who were hospitalized for COVID-19, and the proportion of persons with COVID-19 who died were assessed by age, sex, and race/ethnicity. Additional analyses, for each COVID-19 cases and hospitalized patients, focused on comparisons between persons who identified as Hispanic to those who identified as non-Hispanic (all other racial/ethnic groups combined) to assess differences in sociodemographic characteristics, source of COVID-19 exposure, symptoms, occupation, whether they worked while ill, and household size. Occupational industry codes were categorized as essential or nonessential according to a framework developed for Colorado.† T-tests and Mann-Whitney tests were used to compare continuous variables, and chi-squared tests were used for categorical variables to determine differences between racial/

* https://www.colorado.gov/pacific/cdphe/report-a-disease.

† https://www.coloradohealthinstitute.org/research/colorado-covid-19-social-distancing-index.

ethnic groups; an alpha level of 0.05 was used to determine statistical significance. All analyses were conducted in Stata (version 15.0; StataCorp).

The first event of laboratory-confirmed COVID-19 in a Denver resident was reported on March 6, 2020. During the first 7 months of the epidemic in Denver (March 6–October 6), COVID-19 was diagnosed in 10,163 adults living in noncongregate settings, including 1,087 (10.7%) persons who were hospitalized at the time of diagnosis and 165 (1.6%) who died during this period.

The highest proportions of infection occurred among persons aged 25–44 (49.1%) and 45–64 (26.6%) years (Table 1). Race and ethnicity data were available for 9,056 (89.1%) persons with diagnosed COVID-19. A total of 4,959 (54.8%) of persons diagnosed with COVID-19 in Denver occurred among Hispanic persons, approximately double the proportion of adults in Denver identifying as Hispanic (24.9%) (*1*). In contrast, 32.3% of persons diagnosed with COVID-19 identified as non-Hispanic White (White), and 6.4% identified as non-Hispanic Black or African American (Black), subpopulations that constitute 56.8% and 8.5%, respectively, of Denver adults. The pandemic's initial surge (March 1–June 14, 2020) included more cases and persisted longer among persons of Hispanic ethnicity compared with those of other racial/ethnic groups (Figure). During subsequent surges (June 14–September 5 and September 6–October 3), patterns among Hispanic and White persons were similar, with consistently higher numbers among Hispanic persons.

Hispanic persons accounted for 62.1% of hospitalizations and 51.2% of deaths (Table 1). Whereas Hispanic adults with COVID-19 overall were slightly older than non-Hispanic adults (mean age = 40.8 years versus 39.6 years) (p<0.001), Hispanic adults who were hospitalized with COVID-19 were significantly younger than non-Hispanic adults (mean age = 52.8 years versus 60.2 years) (p<0.001) (Table 2). The distribution of cases was similar among males and females in both Hispanic and non-Hispanic adults. Approximately 90% of both Hispanic and non-Hispanic cases reported symptoms, but Hispanic persons with COVID-19 were significantly more likely than were non-Hispanic persons to report symptoms (p<0.001). Among those who were symptomatic, the median interval between symptom onset and specimen collection was 4 days among Hispanic adults compared with 3 days among non-Hispanic adults (p<0.001). The proportions of Hispanic and non-Hispanic persons who reported experiencing cough, shortness of breath, fatigue, headaches, or diarrhea were similar; however, symptomatic Hispanic patients reported a higher number of total known COVID-19 symptoms (p<0.001) (Table 2). Persons who identified as Hispanic, compared with non-Hispanic, were significantly more likely to report fever or chills (52.7% versus 48.4%; p = 0.03), muscle aches (54.1% versus 48.3%; p<0.001), loss of taste or smell (28.7% versus 22.9%; p<0.001), and a sore throat (34.7% versus 30.7%; p = 0.005).

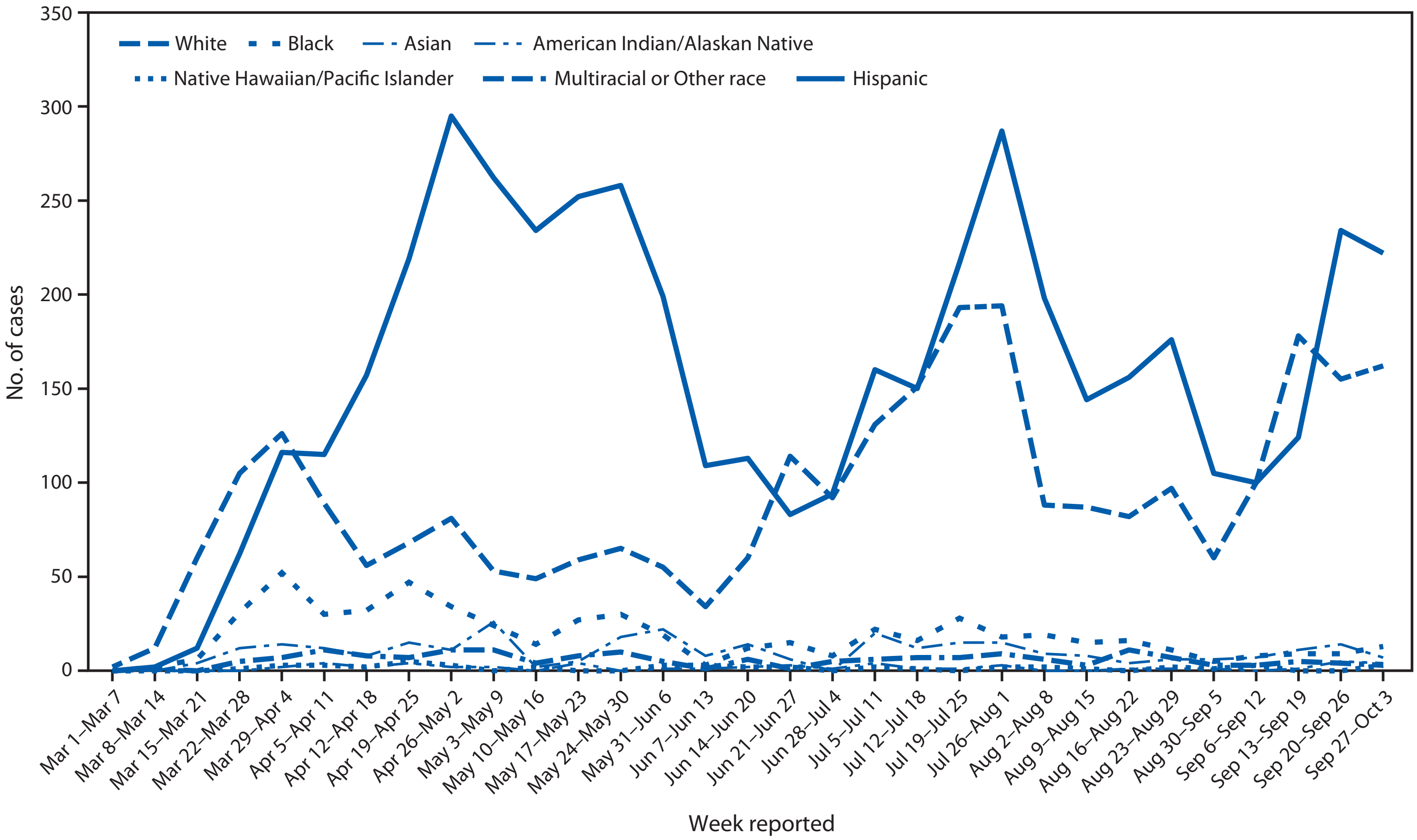
TABLE 1. Sociodemographic characteristics of adults aged ≥18 years* with laboratory-confirmed COVID-19 — Denver, Colorado, March 6, 2020–October 6, 2020

Characteristic (no. with available information)	No. (%)† Cases (n = 10,163)	Hospitalizations (n = 1,087)	Deaths (n = 165)
Age group, yrs (10,163)			
18–24	1,621 (16.0)	37 (3.4)	3 (1.8)
25–44	4,990 (49.1)	245 (22.5)	9 (5.5)
45–64	2,704 (26.6)	462 (42.5)	55 (33.3)
≥65	848 (8.3)	343 (31.6)	98 (59.4)
Sex (10,163)			
Men	4,851 (47.7)	566 (52.1)	106 (64.2)
Women	5,312 (52.3)	521 (47.9)	59 (35.8)
Race/Ethnicity§ (9,056)			
White	2,926 (32.3)	167 (18.2)	36 (29.8)
Black or African American	579 (6.4)	105 (11.5)	14 (11.6)
Hispanic	4,959 (54.8)	569 (62.1)	62 (51.2)
Asian	315 (3.5)	36 (3.9)	3 (2.5)
American Indian/ Alaska Native	51 (0.6)	8 (0.9)	1 (0.8)
Native Hawaiian/ Pacific Islander	47 (0.5)	6 (0.7)	1 (0.8)
Other/Mixed race	179 (2.0)	26 (2.8)	4 (3.3)

Abbreviation: COVID-19 = coronavirus disease 2019.
* In noncongregate living situations.
† Percentages reflect the proportion of persons with nonmissing values for the indicator; race/ethnicity information was available for 9,056 (89.1%) persons.
§ Racial/ethnic categories are mutually exclusive. Hispanic persons could be of any race; other racial/ethnic groups were non-Hispanic (e.g., White = non-Hispanic White). The Other/Mixed race category included persons who identified as two or more different races or who did not identify by the listed race categories or as Hispanic (e.g., Burmese, Egyptian, or Filipino).

A higher percentage of symptomatic Hispanic persons with COVID-19 reported working while ill (86.4%) than did non-Hispanic persons with COVID-19 (77.3%; p<0.001). Among the subset of 2,982 (32.9%) persons with detailed employment information available, 68.8% of Hispanic adults reported working in essential industries compared with 60.2% of non-Hispanic adults (p<0.001). Among 3,917 (39.0%) persons with COVID-19 who provided information about household contacts, 38.3% of Hispanic persons reported five or more persons in the household, compared with 13.4% of non-Hispanic persons reporting the same (p<0.001). In addition, reported exposure to a person with known COVID-19 in the household was significantly higher among persons who identified as Hispanic (23.7%) than among those who identified as non-Hispanic (15.2%), as was reporting both exposure within the household and close contact outside the household with a person with known COVID-19 (2.4% versus 1.7%, respectively; p<0.02).

FIGURE. Adult COVID-19 cases, by race/ethnicity and reported week — Denver, Colorado, March 1–October 3, 2020*



Abbreviation: COVID-19 = coronavirus 2019.
* Only full weeks are depicted in figure during evaluation period.

Discussion

These findings indicate that COVID-19 has disproportionately affected Hispanic persons in the Denver community. Overall, the proportions of COVID-19 cases, hospitalizations, and deaths among Hispanic adults were approximately double the proportion of Hispanic adults in the Denver community. A recent study in Connecticut did not identify significant disparities between persons identifying as Hispanic and those identifying as non-Hispanic, but race/ethnicity data were missing for >55% of cases (*4*); in contrast, race/ethnicity data were available for >89% of patients in the current study. These findings are similar to national data reporting that Hispanic persons have approximately twice the likelihood of serious COVID-19 or death compared with White persons (*5*). This analysis provides a more comprehensive picture of COVID-19 disparities in the Denver community than has been previously available.

Although a higher prevalence of underlying health conditions (e.g., diabetes and obesity) among persons who identify as Hispanic[§] might increase risk for severe disease, cultural and socioeconomic factors related to how persons live and work influence COVID-19 exposure, incidence, and clinical course. Denver adults with COVID-19 who identified as Hispanic were more likely to be members of larger households, to have known exposure to persons with COVID-19, to work in essential industries, and to continue to work while ill, than were those with COVID-19 who identified as non-Hispanic. Whereas social networks among Hispanic persons living in the United States are often viewed as protective for chronic health conditions (*6*), in the case of a readily transmissible infectious disease without any known immunity, such as COVID-19, close networks present elevated risk for exposure and infection. The data from this study show that Hispanic persons in Denver disproportionately work in essential industries such as

[§] https://nccd.cdc.gov/weat/#/crossTabulation/viewReport.

TABLE 2. Sociodemographic and clinical characteristics of adults with laboratory-confirmed COVID-19 and hospitalized COVID-19 patients, by Hispanic ethnicity — Denver Colorado March 6–October 6, 2020

Characteristic	No (%)*		p-value
	Non-Hispanic	Hispanic	
Cases (N = 9,056)			
No. (% of total cases)	**4,097 (45.2)**	**4,959 (54.8)**	—
Mean age (SD), yrs	39.6 (0.3)	40.8 (0.2)	<0.001
Age group, yrs			
18–24	698 (17.0)	771 (15.5)	<0.001
25–44	2,127 (51.9)	2,339 (47.2)	
45–64	882 (21.5)	1,532 (30.9)	
≥65	390 (9.5)	317 (6.4)	
Sex			
Men	1,979 (48.3)	2,309 (46.6)	0.10
Women	2,118 (51.7)	2,650 (53.4)	
Symptomatic			
No	325 (9.0)	249 (5.7)	<0.001
Yes	3,272 (90.7)	4,134 (94.3)	
Days from symptom onset to laboratory test (symptomatic cases only)			
Median (IQR)	3 (1,6)	4 (2,7)	<0.001
No. of known COVID-19 symptoms† at diagnosis (symptomatic cases only)			
1	360 (11.5)	346 (8.7)	<0.001
2–4	1,499 (47.8)	1,924 (48.3)	
5–6	952 (30.3)	1,191 (29.9)	
>6	328 (10.4)	523 (13.1)	
Worked while ill (symptomatic cases only)			
No	325 (22.7)	249 (13.6)	<0.001
Yes	1,110 (77.3)	1,585 (86.4)	
Work in essential industry§			
No	476 (39.8)	558 (31.2)	<0.001
Yes	719 (60.2)	1,229 (68.8)	
No. of persons in household¶			
1 (lives alone)	345 (19.6)	138 (6.4)	<0.001
2	657 (37.3)	387 (18.0)	
3–4	534 (29.7)	803 (37.3)	
5–6	173 (9.8)	599 (27.8)	
>6	64 (3.6)	227 (10.5)	
Source of exposure: known household contact			
No	3,474 (84.8)	3,785 (76.3)	<0.001
Yes	623 (15.2)	1,174 (23.7)	
Source of exposure: close contact			
No	3,371 (82.3)	4,159 (83.9)	0.04
Yes	726 (17.7)	800 (16.1)	
Source of exposure: household and close contact			
No	4,027 (98.3)	4,840 (97.6)	0.02
Yes	70 (1.7)	119 (2.4)	
Hospitalizations (N = 917)			
No. (% of total hospitalizations)	**348 (38.0)**	**569 (62.1)**	
Mean age (SD)	60.2 (0.9)	52.8 (0.7)	<0.001
Age group, yrs			
18–24	8 (2.3)	26 (4.6)	<0.001
25–44	69 (19.8)	157 (27.6)	
45–64	131 (37.6)	251 (44.1)	
≥65	140 (40.2)	135 (23.7)	
Sex			
Men	185 (53.2)	292 (51.3)	0.59
Women	163 (46.8)	277 (48.7)	

Abbreviations: COVID-19 = coronavirus disease 2019; IQR = interquartile range; SD = standard deviation.

* Race and ethnicity data available for 9,056 of 10,163 cases (89.1%) and 917 of 1,087 (84.4%) hospitalizations. Percentages reflect proportion of persons with non-missing values for the indicator.

† Known COVID-19 symptoms include fever or chills, cough, shortness of breath, fatigue, muscle aches, headache, new loss of taste or smell, sore throat, nausea or vomiting, and diarrhea. Range = 1–9.

§ Detailed information on employment was only obtained on a subset of cases (n = 2,982, 33%), as collection of this information began later in the epidemic. Specified proportions of workers in each of the following 10 sectors are considered essential in Colorado: agriculture, forestry, fishing and hunting (100%); mining (100%); construction (100%); manufacturing (100%); wholesale trade (100%); retail trade (60%); transportation, warehousing, and utilities (100%); waste management (18%); education, health care and social assistance (100%); food services (64%); other services, including auto repair, child care, banks, and laundries (40%).

¶ Household size was only available for a subset of cases (n = 3,917, 43%), because this field was introduced later in the epidemic as obtaining information on close contacts for contact tracing became part of standard case interviews.

agriculture, construction, health care, food services, and waste management, where workers might continue working while ill because of economic concerns or lack of paid medical leave (*7*,*8*). In addition, Hispanic adults were more likely to report symptoms and have symptoms for 1 day longer than were non-Hispanic adults before seeking laboratory testing, which might reflect barriers related to testing and health care access (*8*).

The findings in this report are subject to at least five limitations. First, information was obtained at the time of the case report, and limited information was available on outcomes after the interview. Second, data for patients who could not be contacted, who were hospitalized, or who had died were gathered through electronic medical records, which might not be as comprehensive as are interviews. Third, the interview form underwent multiple iterations to better respond to the evolving epidemic; thus, information on employment and household size was not available for all cases. Fourth, persons were categorized as Hispanic or non-Hispanic for the majority of comparisons examining sociodemographic and clinical factors after the initial comparison across different race/ethnicity categories revealed the majority of the incidence among Hispanic persons. Persons of Hispanic ethnicity are not a homogenous group, and this aggregation did not allow for further examination by racial category among the Hispanic population. Finally, because of the need for Denver Public Health to serve as a trusted support for persons with COVID-19, information on immigration status was not solicited. However, Hispanic immigrants might be more likely to hold jobs that do not include paid medical leave and might have limited access to health care, resulting in seeking health care later and poorer outcomes (*7*,*8*).

Summary

What is already known about this topic?

Racial and ethnic disparities of COVID-19 have been noted at the national level, but community-level data are limited.

What is added by this report?

In Denver, Colorado, the majority of adult COVID-19 cases (55%), hospitalizations (62%), and deaths (51%) were among Hispanic adults, double the proportion of Hispanic adults in Denver (24.9%). Among adults with COVID-19, Hispanic persons reported larger household sizes and more known COVID-19 household exposure, working in essential industries, working while ill, and delays in testing after symptom onset.

What are the implications for public health practice?

Public health, health systems, and social services need to address systemic inequalities to mitigate the disproportionate incidence of COVID-19 in Hispanic persons.

In this study of COVID-19 cases in Denver, Hispanic persons were at increased risk for acquiring COVID-19, which might be partially attributable to frequent household and workplace exposure and for COVID-19–associated hospitalization and death. A constellation of community, system, and individual factors, including systemic discrimination, likely lead to health inequalities that have been amplified by the COVID-19 epidemic. Public health and clinical health systems have opportunities and obligations to address health inequities in the communities they serve. Because several factors leading to disproportionate exposure, such as crowded housing and lack of paid medical leave, are attributable to upstream social drivers and outside the traditional health care system, public health and health care systems should partner with social service organizations and community health workers to address patients' unmet social, medical, and mental health needs while providing culturally congruent prevention information on COVID-19 (*9*).

Corresponding author: Laura Jean Podewils, laura.podewils@dhha.org.

[1]Denver Public Health, Denver Health and Hospital Authority, Denver, Colorado; [2]Office of Research, Denver Health and Hospital Authority, Denver, Colorado; [3]School of Public Health, University of Colorado Anschutz Medical Campus, Denver, Colorado; [4]Department of Medicine, Denver Health and Hospital Authority, Denver, Colorado; [5]Department of Medicine, University of Colorado Anschutz Medical Campus, Denver, Colorado.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Census Bureau. American community survey: 2018. Washington, DC: US Department of Commerce, Census Bureau; 2018. https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2018/
2. Council of State and Territorial Epidemiologists Occupational Health Subcommittee. Recommended interim guidance for collecting employment information about COVID-19 cases. Atlanta, GA: Council of State and Territorial Epidemiologists; 2020. https://cdn.ymaws.com/www.cste.org/resource/resmgr/publications/Guidance_collecting_io_covid.pdf
3. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009;42:377–81. PMID:18929686 https://doi.org/10.1016/j.jbi.2008.08.010
4. Laurencin CT, McClinton A. The COVID-19 pandemic: a call to action to identify and address racial and ethnic disparities. J Racial Ethn Health Disparities 2020;7:398–402. PMID:32306369 https://doi.org/10.1007/s40615-020-00756-0
5. CDC. Coronavirus disease 2019 (COVID-19): COVID-19 in racial and ethnic minority groups. Atlanta, GA: US Department of Health and Human Services, CDC; 2020. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/racial-ethnic-minorities.html
6. Viruell-Fuentes EA, Schulz AJ. Toward a dynamic conceptualization of social ties and context: implications for understanding immigrant and Latino health. Am J Public Health 2009;99:2167–75. PMID:19833986 https://doi.org/10.2105/AJPH.2008.158956
7. Gany F, Novo P, Dobslaw R, Leng J. Urban occupational health in the Mexican and Latino/Latina immigrant population: a literature review. J Immigr Minor Health 2014;16:846–55. PMID:23468371 https://doi.org/10.1007/s10903-013-9806-8
8. CDC. Coronavirus disease 2019: community, work and school. Health equity considerations and racial and ethnic minority groups. Atlanta, GA: US Department of Health and Human Services, CDC; 2020. https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html
9. Goldfield NI, Crittenden R, Fox D, McDonough J, Nichols L, Lee Rosenthal E. COVID-19 crisis creates opportunities for community-centered population health: community health workers at the center. J Ambul Care Manage 2020;43:184–90. PMID:32467431 https://doi.org/10.1097/JAC.0000000000000337

Regional Analysis of Coccidioidomycosis Incidence — California, 2000–2018

Gail L. Sondermeyer Cooksey, MPH[1]; Alyssa Nguyen[1]; Duc Vugia, MD[1]; Seema Jain, MD[1]

Coccidioidomycosis (Valley fever) is an infection caused by the soil-dwelling fungus *Coccidioides* spp., which usually manifests as a mild self-limited respiratory illness or pneumonia but can result in severe disseminated disease and, rarely, death (*1*,*2*). In California, coccidioidomycosis incidence increased nearly 800% from 2000 (2.4 cases per 100,000 population) to 2018 (18.8) (*2*–*4*). The California Department of Public Health (CDPH) reports statewide and county-level coccidioidomycosis incidence annually; however, a comprehensive regional analysis has not been conducted. Using California coccidioidomycosis surveillance data during 2000–2018, age-adjusted incidence rates were calculated, and coccidioidomycosis epidemiology was described in six regions. During 2000–2018, a total of 65,438 coccidioidomycosis cases were reported in California; median statewide annual incidence was 7.9 per 100,000 population and varied by region from 1.1 in Northern and Eastern California to 90.6 in the Southern San Joaquin Valley, with the largest increase (15-fold) occurring in the Northern San Joaquin Valley. When analyzing demographic data, which was available for >99% of cases for sex and age and 59% of cases for race/ethnicity, median annual incidence was high among males (10.2) and Black persons (9.0) consistently across all regions; however, incidence varied among Hispanics and adults aged 40–59 years by region. Tracking these surveillance data at the regional level reinforced understanding of where and among what demographic groups coccidioidomycosis rates have been highest and revealed where rates are increasing most dramatically. The results of this analysis influenced the planning of a statewide coccidioidomycosis awareness campaign so that the messaging, including social media and TV and radio segments, focused not only on the general population in the areas with the highest rates, but also in areas where coccidioidomycosis is increasing at the fastest rates and with messaging targeted to groups at highest risk in those areas.

Coccidioidomycosis incidence is highest in the southwestern United States, with approximately 97% of cases reported from Arizona and California (*1*,*2*). Environmental data on where *Coccidioides* exists in the soil are limited; therefore, understanding the geographic risk for infection is largely based on human surveillance data. In California, from 1995 to 2011, annual coccidioidomycosis incidence fluctuated from a low of 1.9 cases per 100,000 in 1997 to a high of 13.9 in 2011. In 2014, incidence declined to 6.0, then increased to 19.3 (>200% increase) in 2017 and remained high (18.8) in 2018. Over the last 18 years, median annual incidence was less than two per 100,000 population in two thirds (39 of 58) of California counties, although it ranged from 13 to 182 in seven counties located in the Central Valley and Central Coast (*3*,*4*). Incidence has been consistently high in six counties in the Southern San Joaquin Valley (Fresno, Kern, Kings, Madera, and Tulare counties) and Central Coast (San Luis Obispo County) regions (*3*,*4*). Coccidioidomycosis has been reportable in California since 1995 and laboratory-reportable since 2014 (*2*–*4*). From 1995 to 2018, the 61 California local health jurisdictions reported data to CDPH using the Council of State and Territorial Epidemiologists case definition for coccidioidomycosis, which includes clinical and laboratory criteria* (*5*). Because of the high disease incidence and resources needed to confirm symptoms, some local health jurisdictions recently transitioned to a laboratory-only case definition for coccidioidomycosis; the final determination of a confirmed case is decided by the local health jurisdiction. For this analysis, regions were based on historic county-level coccidioidomycosis surveillance data and geographic environmental and climatic factors that might affect where *Coccidioides* could proliferate in California; counties were grouped into regions based on similar coccidioidomycosis incidence and environmental profiles (*3*–*6*). The six regions were the 1) Central Coast, 2) Northern and Eastern California, 3) Northern San Joaquin Valley, 4) Southern Coast, 5) Southern Inland, and 6) Southern San Joaquin Valley.

Using 2000–2018 California coccidioidomycosis surveillance data, age-adjusted annual incidence rates were calculated statewide and by region per 100,000 population using population data from the California Department of Finance derived from the 2000 U.S. Census.† A confirmed case was defined as coccidioidomycosis in a California resident as determined by the local health jurisdiction. To describe recent incidence increases, rate ratios were calculated, including by region, to compare rates in 2000 and 2014 with those in 2018. The relative risk for coccidioidomycosis and corresponding 95% confidence intervals were calculated by year (continuous), sex, age group, race/ethnicity, and region using multivariable negative binomial regression (with statistical significance defined as p<0.05) to assess trends and demographic differences by region. This model was fit to the aggregated statewide data, both unadjusted

* https://wwwn.cdc.gov/nndss/conditions/coccidioidomycosis/case-definition/2011.

† https://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

and adjusted for region, and stratified by region. A multivariable analysis was not conducted for the Northern and Eastern California region because of insufficient power. Because specific race/ethnicity data were missing ("Other" or "Unknown") for 41% of reported cases, the multivariable model was restricted to cases with complete data. All analyses were performed using SAS (version 9.4; SAS Institute).

During 2000–2018, a total of 65,438 coccidioidomycosis cases were reported in California, with a median age-adjusted annual incidence of 7.9 per 100,000 population. Annual age-adjusted statewide incidence was lowest in 2000 (2.4), peaked in 2017 (18.9), and decreased slightly in 2018 (18.3) (Supplementary Table, https://stacks.cdc.gov/view/cdc/97708). The highest median annual incidences were in the Southern San Joaquin Valley (90.6), Central Coast (9.7), and Northern San Joaquin Valley (5.6); and lowest in the Southern Coast (2.7), Southern Inland (2.2) and Northern and Eastern California (1.1) (Table 1). In all regions, incidence was higher among males than among females, among persons aged ≥40 years than among those aged <40 years; and, for cases where race/ethnicity data were present, among Black persons than among other racial/ethnic groups.

During the study period, incidence increased statewide and by region (Figure). When comparing the incidence in 2018 statewide with that in 2000, the rate ratio was 7.5, with highest rate ratios in the Northern San Joaquin Valley (15.3) and Southern Coast (8.8). Comparing incidence in 2018 with that in 2014, the highest rate ratio was in the Central Coast (8.1) and ranged from 2.5–3.3 in all other regions.

In statewide and regional multivariable models, which included only cases with complete demographic data, the relative risk (RR) for coccidioidomycosis among males compared with that among females ranged from 1.91 (Southern Coast) to 2.86 (Southern Inland) (Table 2). Compared with cases in persons aged <20 years, the RR was highest among adults aged 40–59 years (RR = 4.03) in the statewide unadjusted model. After adjusting for region, the RR was highest among adults aged ≥60 years (RR = 5.92). When stratified by region, RR was highest among adults aged 40–59 years in the Southern San Joaquin Valley (3.89) and Central Coast (5.24); and highest among adults aged ≥60 years in all other regions (range = 7.37–12.56). In the statewide unadjusted model, RRs were similarly higher among Black (1.76) and Hispanic persons (1.81), compared with White persons. However, when adjusted for region, the RRs for Black and Hispanic persons were 2.13 and 1.21, respectively. When stratified by region, Hispanic persons were at significantly higher risk than were Whites in the Southern San Joaquin Valley (1.55) and the Northern San Joaquin Valley (1.41), whereas the RR for Black persons was significantly higher in all regions, ranging from 1.84 to 2.25.

Discussion

The Southern San Joaquin Valley and Central Coast regions have the highest consistent coccidioidomycosis incidences in California, and the hot, dry climate and environment in

TABLE 1. Demographic characteristics of persons with confirmed coccidioidomycosis cases (n = 65,438), by region of residence* — California, 2000–2018

	No. (%) [incidence]†						
		Regions*					
Characteristic	California	Southern San Joaquin Valley	Central Coast	Northern San Joaquin Valley	Southern Coast	Southern Inland	Northern and Eastern California
Overall	**65,438 (100) [7.9]**	**42,198 (100) [90.6]**	**5,312 (100) [9.7]**	**2,890 (100) [5.6]**	**9,999 (100) [2.7]**	**1,964 (100) [2.2]**	**2,772 (100) [1.1]**
Sex							
Male	41,902 (64.6) [10.2]	26,776 (63.8) [110.9]	3,569 (67.2) [13.4]	1,901 (66.1) [8.2]	6,267 (62.9) [3.4]	1,400 (71.3) [3.3]	1,989 (72.3) [1.7]
Female	22,943 (35.4) [5.5]	15,204 (36.2) [60.4]	1,740 (32.8) [5.5]	977 (33.9) [3.2]	3,698 (37.1) [1.9]	563 (28.7) [1.2]	761 (27.7) [0.5]
Age group (yrs)							
0–19	7,304 (11.2) [3.1]	6,009 (14.2) [32.5]	415 (7.8) [2.4]	229 (7.9) [1.4]	441 (4.4) [0.5]	88 (4.5) [0.2]	122 (4.4) [0.2]
20–39	21,147 (32.5) [9.3]	15,743 (37.3) [104.7]	1,366 (25.7) [9.9]	633 (21.9) [5.7]	2,253 (22.5) [2.1]	481 (24.5) [1.7]	671 (24.2) [0.2]
40–59	23,583 (36.2) [10.8]	14,485 (34.3) [123.0]	2,129 (40.1) [15.4]	1,205 (41.7) [11.2]	3,828 (38.3) [3.7]	809 (41.2) [3.3]	1,127 (40.7) [1.6]
≥60	13,101 (20.1) [7.9]	5,961 (14.1) [70.8]	1,402 (26.4) [14.9]	823 (28.5) [8.0]	3,477 (34.8) [5.6]	586 (29.8) [4.0]	852 (30.7) [2.0]
Race/Ethnicity							
White	14,024 (33.0) [4.3]	7,072 (27.5) [39.2]	2,108 (51.2) [8.7]	518 (34.5) [2.8]	3,273 (39.2) [1.9]	509 (36.6) [1.3]	544 (39.1) [0.3]
Black	4,062 (9.6) [9.0]	2,378 (9.2) [123.8]	235 (5.7) [19.2]	111 (7.4) [8.1]	956 (11.4) [3.7]	184 (13.2) [2.8]	198 (14.2) [1.2]
Hispanic	19,484 (45.9) [7.1]	13,874 (54.0) [60.0]	1,420 (34.5) [8.2]	569 (37.9) [5.3]	2,787 (33.4) [2.1]	516 (37.1) [1.7]	318 (22.8) [0.6]
API	2,763 (6.5) [2.4]	1,122 (4.4) [38.6]	164 (4.0) [7.1]	185 (12.3) [7.4]	962 (11.5) [1.6]	92 (6.6) [1.7]	238 (17.1) [0.3]

Abbreviation: API = Asian/Pacific Islander.

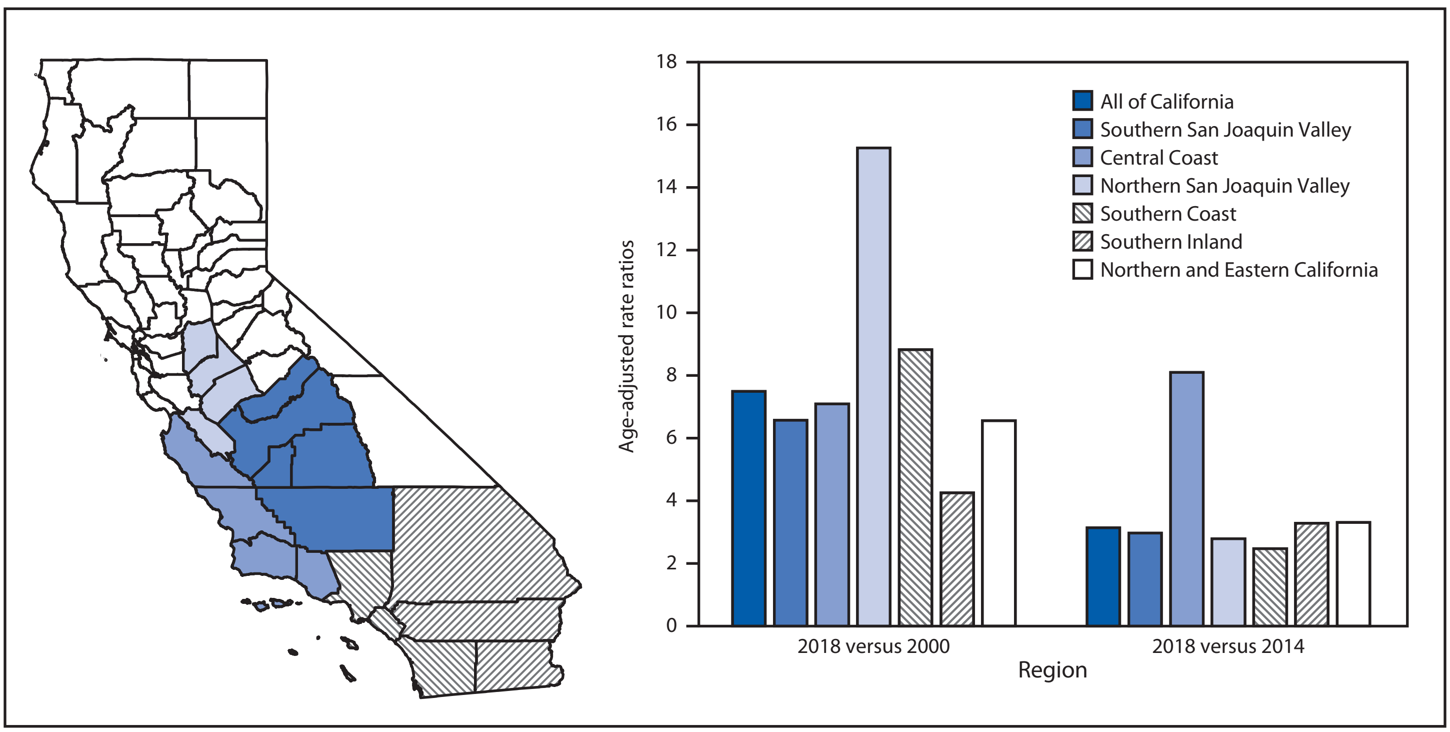
* Southern San Joaquin Valley (Fresno, Kern, Kings, Madera, and Tulare counties), Central Coast (Monterey, San Luis Obispo, Santa Barbara, and Ventura counties), Northern San Joaquin Valley (Merced, San Benito, San Joaquin, and Stanislaus counties), Southern Coast (Los Angeles, Orange, and San Diego counties), Southern Inland (Imperial, Riverside, and San Bernardino counties), and Northern and Eastern California (all other California counties).

† Cases per 100,000 population; median annual incidence from 2000 to 2018 was age-adjusted to the United States 2000 standard population.

these regions is known to be suitable for *Coccidioides* proliferation; predictive ecological niche modeling has indicated that *Coccidioides* could expand to other areas (*6*). Although increasing case counts in the Southern San Joaquin Valley have contributed most to the overall increases in statewide coccidioidomycosis incidence, these regional analyses indicate that the largest increases in incidence occurred outside the Southern San Joaquin Valley, particularly in the Northern San Joaquin Valley and Southern Coast, and, since 2014, in the Central Coast. During this time, coccidioidomycosis outbreaks were infrequently reported (approximately one or two per year) and would not have affected overall surveillance trends. Although these increases in previously lower-incidence regions could reflect expanding areas where *Coccidioides* can proliferate, they might also reflect regional changes in work or recreation travel patterns, testing and reporting practices, or population susceptibility. Outside of California, coccidioidomycosis incidence also increased during 2000–2011 in Arizona, which reports approximately 65% of national cases, and in other states, which report approximately 3% of national cases, after which incidence either decreased or remained stable in those areas (*2*,*7*).

Black persons and older adults are known to be at increased risk for severe coccidioidomycosis (i.e., hospitalization or disseminated disease) (*8*) and were consistently found to be at higher risk for coccidioidomycosis in all California regions; the reasons for this are not completely understood but might include host characteristics (e.g., genetic factors and prevalence of comorbidities) and societal factors, (e.g., access to care and socioeconomic status) (*8,9*). The risk for coccidioidomycosis in males has consistently been higher than that for females over time and by region, possibly related to exposure from outdoor work or recreational activities (*3*,*4*). In contrast, coccidioidomycosis risk in Hispanics compared with that in Whites and in adults aged 40–59 years compared with that in persons aged <20 years varied by region, suggesting that infection in these groups might be more influenced by environmental exposures in certain regions, possibly related to work or recreational outdoor activities, particularly those involving dirt or dust. The majority of coccidioidomycosis outbreaks in California have occurred in high-incidence regions and have been associated with dirt-disturbing work settings, including construction, military, archeologic sites, and correctional institutions, where high attack rates have been seen even among relatively young,

FIGURE. Designated regions* of California and the ratios of age-adjusted† annual coccidioidomycosis incidence by California region, 2018 versus 2000 and 2018 versus 2014



* Southern San Joaquin Valley (Fresno, Kern, Kings, Madera, and Tulare counties), Central Coast (Monterey, San Luis Obispo, Santa Barbara, and Ventura counties), Northern San Joaquin Valley (Merced, San Benito, San Joaquin, and Stanislaus counties), Southern Coast (Los Angeles, Orange, and San Diego counties), Southern Inland (Imperial, Riverside, and San Bernardino counties), and Northern and Eastern California (all other California counties).

† All rates were age-adjusted to the United States 2000 standard population.

healthy populations (*10*). Further research is needed to better delineate the factors associated with increased risk in these groups in some but not all regions.

The findings in this report are subject to at least four limitations. First, the data were limited by the quality of provider and laboratory-based coccidioidomycosis reporting and local health jurisdiction ability to review and confirm cases; these results might mostly reflect patients with moderate or severe coccidioidomycosis, including those at higher risk for severe disease such as Black persons and older adults, because mild illness is less likely to be diagnosed and reported. Second, cases were reported based on patients' residential address, which might not reflect the exposure area. Third, although the most common types of diagnostic test used for coccidioidomycosis during this period have not changed, it is not known whether and how testing practices might have changed and how that might have affected incidence in various regions or among certain groups. Finally, 41% of cases had an unknown or other race-ethnicity; therefore, regional estimates by race/ethnicity might be biased by the counties where reporting was more complete.

In a large, diverse state, such as California, analysis of coccidioidomycosis surveillance data at a regional level improved the understanding of disease trends, emergence, and epidemiology and informed efforts to improve public and provider awareness, directing messaging to areas with increasing trends that are outside of the typical high incidence regions. Currently, no effective methods are known for primary prevention of coccidioidomycosis (e.g., a vaccine); therefore, widespread awareness is important to prompt early diagnosis, proper management, possible antifungal treatment, and better outcomes. The results of these analyses helped focus statewide and regional outreach efforts, including targeted social media messages and the distribution of awareness resources to communities at risk in areas with high or increasing incidence and assisted in identifying the most affected demographic and occupational groups to target within specific regions.

Acknowledgments

California local health departments; CDC Epidemiology and Laboratory Capacity for Infectious Diseases Cooperative Agreement.

TABLE 2. Multivariable regression models for risk for coccidioidomycosis not adjusted, adjusted, and stratified, by region — California, 2000–2018 (n = 40,264*)

Characteristic	Relative risk† (95% CI)						
	California		Regions§				
	Not adjusted for region	Adjusted for region	Southern San Joaquin Valley	Central Coast	Northern San Joaquin Valley	Southern Coast	Southern Inland
Year (continuous)¶	1.07 (1.06–1.08)	1.08 (1.08–1.09)	1.05 (1.04–1.06)	1.08 (1.07–1.09)	1.10 (1.08–1.11)	1.12 (1.11–1.13)	1.04 (1.02–1.05)
Sex (ref = female)							
Male	2.12 (1.96–2.29)	2.20 (2.09–2.31)	1.95 (1.77–2.13)	2.32 (2.03–2.64)	2.28 (1.98–2.61)	1.91 (1.78–2.04)	2.86 (2.46–3.33)
Age group (yrs) (ref = 0–19)							
20–39	3.04 (2.73–3.39)	3.41 (3.15–3.69)	3.18 (2.79–3.61)	3.00 (2.45–3.68)	3.19 (2.51–4.07)	4.57 (4.00–5.23)	5.34 (3.97–7.18)
40–59	4.03 (3.61–4.50)	5.60 (5.18–6.06)	3.89 (3.41–4.43)	5.24 (4.29–6.39)	6.59 (5.24–8.30)	8.39 (7.35–9.56)	10.28 (7.71–13.70)
≥60	3.77 (3.37–4.21)	5.92 (5.45–6.42)	2.98 (2.60–3.41)	4.64 (3.77–5.71)	7.37 (5.79–9.38)	11.73 (10.27–13.40)	12.56 (9.34–16.89)
Race/Ethnicity (ref = White)							
Black	1.76 (1.59–1.96)	2.13 (1.98–2.29)	2.21 (1.94–2.51)	2.22 (1.81–2.72)	2.09 (1.65–2.63)	1.84 (1.67–2.04)	2.25 (1.83–2.76)
Hispanic	1.81 (1.63–2.00)	1.21 (1.14–1.29)	1.55 (1.37–1.74)	0.92 (0.79–1.07)	1.41 (1.20–1.65)	0.98 (0.90–1.07)	1.07 (0.90–1.27)
API	0.61 (0.55–0.68)	0.98 (0.91–1.06)	1.07 (0.93–1.22)	0.68 (0.55–0.84)	1.72 (1.41–2.10)	0.81 (0.73–0.89)	1.29 (1.00–1.66)
Region of residence (ref = Northern and Eastern California)							
Southern San Joaquin Valley	N/A	90.39 (81.63–100.09)	N/A	N/A	N/A	N/A	N/A
Central Coast	N/A	16.12 (14.46–17.98)	N/A	N/A	N/A	N/A	N/A
Northern San Joaquin Valley	N/A	7.60 (6.76–8.55)	N/A	N/A	N/A	N/A	N/A
Southern Coast	N/A	3.55 (3.20–3.93)	N/A	N/A	N/A	N/A	N/A
Southern Inland	N/A	2.44 (2.16–2.74)	N/A	N/A	N/A	N/A	N/A

Abbreviations: API = Asian/Pacific Islander; CI = confidence interval; cont. = continuous variable; N/A = not applicable; ref = regression reference group.
* Multivariable models included only data from cases with complete sex, age, and race/ethnicity.
† Multivariable relative risk and associated 95% confidence intervals were calculated by negative binomial regression.
§ Southern San Joaquin Valley (Fresno, Kern, Kings, Madera, and Tulare counties), Central Coast (Monterey, San Luis Obispo, Santa Barbara, and Ventura counties), Northern San Joaquin Valley (Merced, San Benito, San Joaquin, and Stanislaus counties), Southern Coast (Los Angeles, Orange, and San Diego counties), Southern Inland (Imperial, Riverside, and San Bernardino counties), and Northern and Eastern California (all other California counties).
¶ Year was included in the model as a continuous variable.

Summary

What is already known about this topic?

Coccidioidomycosis incidence increased in California from 2000 to 2018 and was higher among males, adults aged ≥40 years, Black persons, and residents of Central California.

What is added by this report?

In the first regional analysis of coccidioidomycosis in California, risk was consistently high across California regions among males and Black persons yet varied by region among different age groups and Hispanic ethnicity. Incidence was highest in the Southern San Joaquin Valley, and the largest increase from 2000 to 2018 occurred in the Northern San Joaquin Valley.

What are the implications for public health practice?

Routine regional analysis of coccidioidomycosis data should be performed to better understand where increases are occurring and whether risk by demographic groups varies, and these results should be used to better target and tailor outreach messaging.

Corresponding author: Gail L. Sondermeyer Cooksey, gail.cooksey@cdph.ca.gov, 510-620-3631.

[1]Infectious Diseases Branch, Center for Infectious Diseases, California Department of Public Health.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Galgiani JN, Ampel NM, Blair JE, et al.; Infectious Diseases Society of America. Coccidioidomycosis. Clin Infect Dis 2005;41:1217–23. PMID:16206093 https://doi.org/10.1086/496991
2. CDC. Increase in reported coccidioidomycosis—United States, 1998–2011. MMWR Morb Mortal Wkly Rep 2013;62:217–21. PMID:23535687
3. Division of Communicable Disease Control. Yearly summaries of selected general communicable diseases in California, 2001–2010. Sacramento, CA: California Department of Public Health, Division of Communicable Disease Control; 2018. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/YearlySummaryReportsofSelectedGenCommDiseasesinCA2001-2010.pdf
4. Division of Communicable Disease Control. Epidemiologic summary of coccidioidomycosis in California. Sacramento, CA: California Department of Public Health, Division of Communicable Disease Control; 2018. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CocciEpiSummary2018.pdf
5. Griffith GE, Omernik JM, Smith DW, et al. Ecoregions of California. Reston, VA: US Geological Survey; 2016. http://dx.doi.org/10.3133/ofr20161021
6. Fisher FS, Bultman MW, Johnson SM, Pappagianis D, Zaborsky E. *Coccidioides* niches and habitat parameters in the southwestern United States: a matter of scale. Ann N Y Acad Sci 2007;1111:47–72. PMID:17344527 https://doi.org/10.1196/annals.1406.031
7. Benedict K, McCotter OZ, Brady S, et al. Surveillance for coccidioidomycosis—United States, 2011–2017. MMWR Surveill Summ 2019;68(No. SS-7). http://dx.doi.org/10.15585/mmwr.ss6807a1
8. Rosenstein NE, Emery KW, Werner SB, et al. Risk factors for severe pulmonary and disseminated coccidioidomycosis: Kern County, California, 1995–1996. Clin Infect Dis 2001;32:708–14. PMID:11229838 https://doi.org/10.1086/319203
9. Louie L, Ng S, Hajjeh R, et al. Influence of host genetics on the severity of coccidioidomycosis. Emerg Infect Dis 1999;5:672–80. PMID:10511523 https://doi.org/10.3201/eid0505.990508
10. Pearson D, Ebisu K, Wu X, Basu R. A review of coccidioidomycosis in California: exploring the intersection of land use, population movement, and climate change. Epidemiol Rev 2019;41:145–57. PMID:31497853 https://doi.org/10.1093/epirev/mxz004

Survey of Teen Noise Exposure and Efforts to Protect Hearing at School — United States, 2020

John Eichwald, MA[1]; Franco Scinicariello, MD[2]

Noise-induced hearing loss (NIHL) is a substantial, often unrecognized, health problem. Various learning environments and activities in school settings are loud. Researchers have reported the prevalence of NIHL among U.S. adolescents ranging between 12.8% and 17.5%, suggesting that one in every six to eight middle and high school students (aged 12–19 years) has measurable hearing loss likely resulting from excessive noise exposure (*1*). Evidence suggests that even mild levels of hearing loss negatively affect auditory perception and cognitive skills.* CDC analyzed data from a sample of 817 youths aged 12–17 years who responded to the web-based YouthStyles survey in 2020. The survey measured the frequency of exposure to loud noise in school settings, the provision of hearing protection devices (HPDs) during exposure, and whether prevention techniques were part of their educational curriculum. Approximately three in four teenage students reported being exposed to loud sound at school, and nearly one half (46.5%) of respondents reported exposure to loud sounds at school on a regular basis. A majority of students (85.9%) reported that their school did not provide HPDs during classes or activities where they were exposed to loud sounds, and seven out of 10 reported they were never taught how to protect their hearing. Increasing youth's awareness about the adverse health effects of excessive noise exposure and simple preventive measures to reduce risk can help prevent or reduce NIHL. Health care providers and educators have resources and tools available to prevent NIHL among school-aged children. Increased efforts are needed to promote prevention.

Schools in the United States utilize a variety of policies and practices to ensure that students and staff members are safe from a wide range of physical hazards, including excessive noise exposure. CDC reported that approximately one half of schools (56.5%) and school districts (61.3%) require students to use HPDs during classes or activities in which they are exposed to potentially unsafe noise levels (*2*). That study, a data source for a Healthy People 2020 objective (ECBP-4.6),† demonstrated a marked decrease from 49.4% in 2006 to 35.0% in 2014 in the proportion of K-12 schools educating students in the prevention of vision and hearing loss.

The current study used data from Porter Novelli's 2020 YouthStyles§ survey via Ipsos' KnowledgePanel,¶ an online panel representative of the noninstitutionalized U.S. population. YouthStyles is part of a series of web-based surveys conducted to gather insights about U.S. consumers, including information about their health, attitudes, and behaviors. The survey was fielded during June 10–25, 2020; participants were youths aged 12–17 years residing with parents who are members of the adult SummerStyles panel. Members are randomly recruited by mail using probability-based sampling by address to reach respondents regardless of whether they have landline phones or Internet access. If needed, households are provided with a laptop or tablet and access to the Internet. Parents participated in their survey portion immediately before their child's survey participation and provided electronic consent for their child to participate. Youth-adult dyad households who completed the survey received 10,000 cash-equivalent reward points (worth approximately $10) to be split between the parent and youth respondents. Respondents were not required to answer individual questions and could exit the survey at any time.

The resulting data were weighted to match March 2019 U.S. Census estimates. The adult data were weighted using nine factors: gender, age, household income, race/ethnicity, household size, education, census region, metro status, and parental status of children aged 12–17 years. Youth weights were based off the final adult weights (which incorporate the previously mentioned nine factors) and then adjusted for the following seven factors: youth gender, youth age, household income, youth race/ethnicity, number of teenagers in the household, census region, and metro status. Personal identifiers were not included in the data file. Three questions were included related to this study. Participants were asked to indicate their responses with a forced choice scale (e.g., always, usually, seldom, never). For analysis, researchers dichotomized student answers into two categories for student exposure (every day or two to four times per week/never or every few months), provision of HPDs (always or usually/seldom or never), and hearing protection education (never/at least once or several times). Analyses were

* https://www.biorxiv.org/content/10.1101/723635v1.
† https://www.healthypeople.gov/node/4255/data_details.

§ http://styles.porternovelli.com/consumer-youthstyles/.
¶ https://www.ipsos.com/en-us/solutions/public-affairs/knowledgepanel.

conducted using SAS software (version 9.4; SAS Institute). The PROC SURVEYFREQ procedure of SAS was used for descriptive analysis. Multivariable logistic regressions were used to calculate adjusted odds ratios (aORs), 95% confidence intervals (CIs), and p-values (α = 0.05).

A total of 817 youths (among 1,700 sampled parents) qualified and completed the survey, for a response rate of 48.1%. Among the youths surveyed, 73.6% reported exposure to loud sound at school for >15 minutes a day and nearly one half (46.5%) reported exposure every day or two to four times per week (Table 1). Of those students who reported any exposure, the majority (85.9%) reported that their school did not provide HPDs (seldom or never) during classes or activities where they were exposed to loud sounds. In addition, 70.4% of all respondents reported that they never had a class or coursework that taught how to protect hearing from noise. Most surveyed students were White (51.6%) or lived in a metropolitan area (86.5%). There was no significant difference in exposure reported by sex (Table 2). Students in the South were more likely to be exposed to loud sounds at school on a regular basis than were students in the Northeast (aOR = 1.7; 95% CI = 1.1–2.5). Students at schools with classes or coursework providing information about hearing protection from noise were more likely to report that they were provided with hearing protection devices (aOR = 5.4; 95% CI = 3.3–8.9). Students from households with an average income ≥$150,000 were significantly less likely to have hearing protection provided by the school (aOR = 0.2; 95% CI = 0.1–0.5).

TABLE 1. Selected characteristics regarding youth's exposure to loud sounds at school, the provision of hearing protection devices (HPDs) during classes or activities where they were exposed to loud sounds, and educational coursework on how to protect their hearing — Porter Novelli YouthStyles, United States, 2020

Characteristic	Unweighted no.	Weighted no.	All respondents weighted % (95% CI)
How often exposed to loud sounds at school*			
Every school day	170	179	22.0 (18.5–25.4)
Two to four times per week	197	221	24.5 (21.0–28.1)
Every few months	228	221	27.1 (23.5–30.7)
Never	218	215	26.4 (22.8–30.0)
How often exposed to loud sounds at school (grouped)			
Every day/Two to four times per week	367	379	46.5 (42.4–50.6)
Never/Every few months	446	435	53.5 (49.4–57.6)
All respondents	813	815	NA
How often school provided HPD†			
Always	20	19	3.2 (1.6–4.7)
Usually	61	66	11.0 (7.8–14.1)
Seldom	84	81	13.5 (10.4–16.6)
Never	430	434	72.4 (68.1–76.7)
How often school provided HPD (grouped)			
Always/Usually	81	85	14.1 (10.7–17.5)
Seldom/Never	514	515	85.9 (82.5–89.3)
Hearing protection coursework§			
Never	570	572	70.4 (66.6–74.1)
At least once	208	202	24.8 (21.4–28.3)
Several times	34	39	4.8 (2.8–6.8)
Hearing protection coursework (grouped)			
Never	570	572	70.4 (66.6–74.1)
At least once/Several times	242	241	29.6 (25.9–33.4)
Sex			
Male	410	417	51.1 (47.0–55.2)
Female	407	400	48.9 (44.8–53.0)
Age group, yrs			
12–14	417	401	49.0 (45.0–53.1)
15–17	400	416	51.0 (46.9–55.0)
Race/Ethnicity¶			
White	514	422	51.6 (47.5–55.8)
Black	63	110	13.4 (10.1–16.8)
Hispanic	136	201	24.6 (20.7–28.5)
Other/Multiracial	104	84	9.3 (8.1–12.6)
Income, USD ($)			
<50,000	179	231	28.3 (24.3–32.3)
50,000–84,999	194	198	24.2 (20.8–27.7)
85,000–149,999	277	245	30.0 (26.3–33.6)
≥150,000	167	143	17.6 (14.7–20.4)
U.S. Census region of residence**			
Northeast	148	131	16.0 (13.2–18.8)
Midwest	196	180	22.0 (18.8–25.2)
South	289	308	37.6 (33.6–41.7)
West	184	199	24.3 (20.7–27.9)
Metropolitan statistical area status			
Nonmetropolitan	119	110	13.5 (10.8–16.1)
Metropolitan	698	707	86.5 (83.9–89.2)

Abbreviations: CI = confidence interval; NA = not applicable.

* Panelists were asked "During a normal school year, how often were you exposed to loud sounds at school for more than 15 minutes a day, such as music or industrial arts classes, cafeteria, sporting or dance events? By loud sounds, we mean sounds so loud that you had to raise your voice to be heard by someone at arm's length."

† Panelists were asked "How often does your school provide hearing protection devices, such as earplugs or earmuffs, during classes or activities where you are exposed to loud sounds, such as industrial arts classes and marching band?"

§ Panelists were asked "How often have you had a class or coursework that taught you about how to protect your hearing from noise?"

¶ Persons who identified as White, Black, Asian, or other or multiracial were all non-Hispanic. Persons who identified as Hispanic might be of any race.

** *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

TABLE 2. Multivariable logistic regression comparing frequencies of youths' exposure to loud sounds at school, the provision of hearing protection devices (HPDs) during classes or activities where they were exposed to loud sounds, and educational coursework on how to protect their hearing — Porter Novelli YouthStyles, United States, 2020

Characteristic	aOR (95% CI)		
	Exposed to loud sounds at school every day/two to four times/week versus never/every few months*	School provided HPDs always/usually versus never/seldom†	Hearing protection coursework at least once/several times versus never§
Sex			
Male	Referent	Referent	Referent
Female	1.0 (0.8–1.4)	0.9 (0.6–1.5)	0.89 (0.7–1.2)
Age group, yrs			
12–14	Referent	Referent	Referent
15–17	0.9 (0.7–1.3)	1.2 (0.7–2.0)	1.11 (0.8–1.5)
Race/Ethnicity¶			
White	Referent	Referent	Referent
Black	0.7 (0.4–1.1)	1.7 (0.8–3.8)	1.4 (0.9–2.3)
Hispanic	1.1 (0.8–1.6)	1.3 (0.7–2.5)	1.3 (0.6–2.0)
Other/Multiracial	1.0 (0.6–1.5)	1.4 (0.6–3.4)	1.3 (0.7–2.2)
Income, USD ($)			
<50,000	Referent	Referent	Referent
50,000–84,999	1.2 (0.8–1.7)	0.6 (0.3–1.1)	1.4 (0.9–2.1)
85,000–149,999	0.8 (0.6–1.2)	0.9 (0.5–1.6)	0.9 (0.6–1.4)
≥150,000	0.8 (0.5–1.3)	0.2 (0.1–0.5)**	1.2 (0.7–1.9)
U.S. Census region of residence††			
Northeast	Referent	Referent	Referent
Midwest	1.3 (0.8–2.1)	0.8 (0.4–1.6)	0.8 (0.8–1.3)
South	1.7 (1.1–2.5)**	0.6 (0.3–1.2)	0.7 (0.4–1.1)
West	1.1 (0.7–1.7)	0.6 (0.3–1.4)	0.8 (0.5–1.3)
Metropolitan statistical area status			
Nonmetropolitan	Referent	Referent	Referent
Metropolitan	1.1 (0.7–1.7)	1.0 (0.5–2.0)	0.7 (0.4–1.0)
How often taught to protect your hearing			
Never	Referent	Referent	NA
Several/At least once	1.0 (0.8–1.4)	5.4 (3.3–8.9)**	NA
How often exposed to loud sounds at school			
Never/Every few months	NA	Referent	NA
Every day/two to four times per week	NA	1.2 (0.7–2.1)	NA

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval; NA = not applicable.

* Panelists were asked "During a normal school year, how often were you exposed to loud sounds at school for more than 15 minutes a day, such as music or industrial arts classes, cafeteria, sporting or dance events? By loud sounds, we mean sounds so loud that you had to raise your voice to be heard by someone at arm's length."

† Panelists were asked "How often does your school provide hearing protection devices, such as earplugs or earmuffs, during classes or activities where you are exposed to loud sounds, such as industrial arts classes and marching band?"

§ Panelists were asked "How often have you had a class or coursework that taught you about how to protect your hearing from noise?"

¶ Persons who identified as White, Black, Asian, or other or multiracial were all non-Hispanic. Persons who identified as Hispanic might be of any race.

** Statistical difference at $p<0.05$ compared with the referent group.

†† *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Discussion

This study suggests that approximately three in four students are exposed to loud sounds at school with nearly one half (46.5%) exposed on a routine basis. Among the students reporting exposure (73.6% of all respondents), 85.9% reported that they were not provided hearing protection during class or activities where they were exposed. Among all students responding, fewer than one out of three (29.6%) reported being taught how to protect their hearing during noisy events or activities. A loud sound level in a classroom is not just an annoyance; it can also disrupt academic performance and educational activities (*3*,*4*). Certain classroom environments as well as some related school activities can be loud and might contribute to NIHL (*5*,*6*). The finding that schools providing information about hearing protection were more likely to supply HPDs emphasizes the need for an increased public health focus on raising awareness about the adverse health effects of excessive noise exposure, as well as the importance of protective measures from both internal (e.g. classroom chatter or ventilation systems) and external background noises in school settings. Reported rates of HPD use might have been lowered because of limited use during participation in marching band; however, some school programs do offer special filtered musician earplugs for their students.

The findings in this report are subject to at least four limitations. First, data are subject to sampling biases because data could be collected only from youths who chose to respond to the survey and had participating parents who provided consent for them to participate. Second, the data obtained in this survey were self-reported, relying on respondents' perception of loudness and recall of events. Third, the survey did not ask parents whether their child attended a public or private school. Finally, there were small numbers in certain groups, resulting in wide CIs for estimates for these subgroups.

Both the World Health Organization (*7*) and the U.S. National Academies of Sciences, Engineering, and Medicine (*8*) have recommended that national governments improve public information on hearing and hearing health care through educational awareness campaigns. Promotion of three simple prevention techniques can protect hearing from excessive noise exposure: lowering the volume of audio equipment and devices, moving away from the sound source, and wearing hearing protectors, such as earplugs or earmuffs.

The Noisy Planet campaign** developed by the National Institutes of Health and the public health educational materials developed by CDC's NIHL program†† in the National Center for Environmental Health (NCEH) are designed to increase awareness of the negative health effects from loud noise exposure. The Dangerous Decibels program§§ has developed effective classroom-based educational materials on hearing loss prevention designed to increase knowledge and positively change attitudes and intended behaviors of school-aged children (*9*).

NCEH has created educational products targeted specifically for school-aged children, including a downloadable 10-page graphic novel, How Loud is Too Loud?¶¶ In an agreement with Scholastic Magazine, 11,871 hard copies were distributed with the April 2020 edition of their SuperScience magazine to teachers of grades 3–6 in all 50 states, the District of Columbia, Guam, and the Armed Forces Europe/Armed Forces Pacific schools. A four-page standards-based teacher's guide with lesson plans was included with the comic. Both tools provide information about NIHL and promote the three prevention techniques. Discussions between patients and health care providers regarding the consequences of excessive sound exposure and the potential benefits to health from the use of hearing protection might provide opportunities to prevent or reduce harmful effects. Educators, as well as school audiologists and nurses, have free resources and tools available to teach youths about the causes and prevention of NIHL.

** https://www.noisyplanet.nidcd.nih.gov.
†† https://www.cdc.gov/nceh/hearing_loss.
§§ http://dangerousdecibels.org.
¶¶ https://www.cdc.gov/healthyschools/bam/pdf/how_loud_is_too_loud-508.pdf.

Summary

What is already known about this topic?

Noise-induced hearing loss is a substantial, often unrecognized, health problem. Various learning environments and activities in school settings are loud.

What is added by this report?

Approximately three in four teenage students report being exposed to loud sound at school, and nearly one half (46.5%) report exposure on a regular basis. However, most report that their school did not provide hearing protection equipment or teach preventive techniques to reduce their risk of permanent noise-induced hearing loss.

What are the implications for public health practice?

Health care providers and educators have resources available to prevent noise-induced hearing loss among school-aged children. Increasing youths' awareness about adverse health effects of excessive noise exposure and simple preventive measures to reduce risk can help prevent or reduce noise-induced hearing loss.

Acknowledgments

Members of the CDC Noise-Induced Hearing Loss Workgroup; Office of Laboratory Science, CDC; Safety and the School Health Branch, National Center for Chronic Disease Prevention and Health Promotion, CDC.

Corresponding author: John Eichwald, jeichwald@cdc.gov, 404-498-3961.

[1]Office of Science, National Center for Environment Health, CDC; [2]Office of Innovation and Analytics, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. Su BM, Chan DK. Prevalence of hearing loss in US children and adolescents: findings from NHANES 1988–2010. JAMA Otolaryngol Head Neck Surg 2017;143:920–7. PMID:28750123 https://doi.org/10.1001/jamaoto.2017.0953
2. CDC. Adolescent and school health: SHPPS results. Atlanta, GA: US Department of Health and Human Services, CDC; 2019. https://www.cdc.gov/healthyyouth/data/shpps/results.htm
3. Connolly D, Dockrell J, Shield B, Conetta R, Mydlarz C, Cox T. The effects of classroom noise on the reading comprehension of adolescents. J Acoust Soc Am 2019;145:372–81. PMID:30710912 https://doi.org/10.1121/1.5087126

4. Shield BM, Dockrell JE. The effects of environmental and classroom noise on the academic attainments of primary school children. J Acoust Soc Am 2008;123:133–44. PMID:18177145 https://doi.org/10.1121/1.2812596
5. Fidêncio VL, Moret AL, Jacob RT. Measuring noise in classrooms: a systematic review. CoDAS 2014;26:155–8. PMID:24918509 https://doi.org/10.1590/2317-1782/2014029IN
6. Ramrattan H, Gurevich N. Prevalence of noise-induced hearing loss in middle and high school band members: a preliminary study. Folia Phoniatr Logop 2020;72:302–8. PMID:31302650 https://doi.org/10.1159/000501154
7. World Health Organization; International Telecommunication Union. Toolkit for safe listening devices and systems. Geneva, Switzerland: World Health Organization; International Telecommunication Union; 2019. https://apps.who.int/iris/handle/10665/280086
8. National Academies of Sciences, Engineering, and Medicine. Hearing health care for adults: priorities for improving access and affordability. Washington, DC: National Academies Press; 2016.
9. Griest SE, Folmer RL, Martin WH. Effectiveness of “Dangerous Decibels,” a school-based hearing loss prevention program. Am J Audiol 2007;16:S165–81. PMID:18056870 https://doi.org/10.1044/1059-0889(2007/021)

Increase in Hospital-Acquired Carbapenem-Resistant *Acinetobacter baumannii* Infection and Colonization in an Acute Care Hospital During a Surge in COVID-19 Admissions — New Jersey, February–July 2020

Stephen Perez, PhD[1,2]; Gabriel K. Innes, VMD, PhD[2]; Maroya Spalding Walters, PhD[3]; Jason Mehr, MPH[2]; Jessica Arias[2]; Rebecca Greeley, MPH[2]; Debra Chew, MD[4]

On December 1, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Carbapenem-resistant *Acinetobacter baumannii* (CRAB), an opportunistic pathogen primarily associated with hospital-acquired infections, is an urgent public health threat (*1*). In health care facilities, CRAB readily contaminates the patient care environment and health care providers' hands, survives for extended periods on dry surfaces, and can be spread by asymptomatically colonized persons; these factors make CRAB outbreaks in acute care hospitals difficult to control (*2*,*3*). On May 28, 2020, a New Jersey hospital (hospital A) reported a cluster of CRAB infections during a surge in patients hospitalized with coronavirus disease 2019 (COVID-19). Hospital A and the New Jersey Department of Health (NJDOH) conducted an investigation, and identified 34 patients with hospital-acquired multidrug-resistant CRAB infection or colonization during February–July 2020, including 21 (62%) who were admitted to two intensive care units (ICUs) dedicated to caring for COVID-19 patients. In late March, increasing COVID-19–related hospitalizations led to shortages in personnel, personal protective equipment (PPE), and medical equipment, resulting in changes to conventional infection prevention and control (IPC) practices. In late May, hospital A resumed normal operations, including standard IPC measures, as COVID-19 hospitalizations decreased, lessening the impact of personnel and supply chain shortages on hospital functions. CRAB cases subsequently returned to a pre–COVID-19 baseline of none to two cases monthly. The occurrence of this cluster underscores the potential for multidrug-resistant organisms (MDROs) to spread during events when standard hospital practices might be disrupted; conventional IPC strategies should be reinstated as soon as capacity and resources allow.

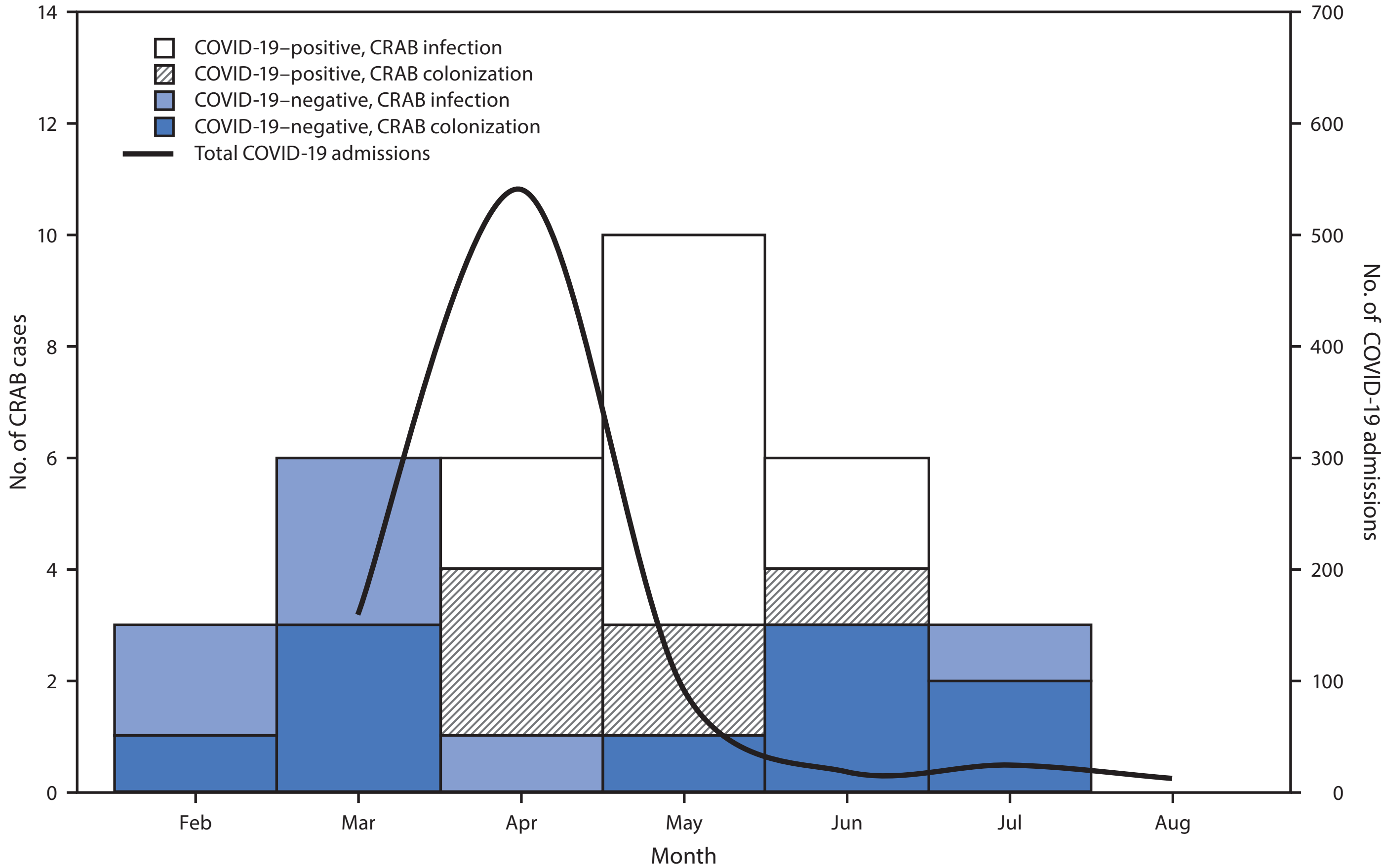
Hospital A is an urban, acute-care hospital in New Jersey with approximately 500 beds. In May 2020, hospital A notified NJDOH of an increase in CRAB (*A. baumannii* with meropenem minimum inhibitory concentration testing of ≥8 μg/mL) isolates from weekly ICU point prevalence surveys (colonization screening) and from clinical infections. Hospital A retrospectively reviewed microbiology records for CRAB isolated from inpatient specimens since November 2019 and instituted prospective surveillance of laboratory results to identify all CRAB isolates. Inpatients with hospital-acquired CRAB infection were defined as those for whom CRAB was isolated from clinical or colonization screening specimens collected on or after hospital day 3 and who had no earlier CRAB isolated from specimens during the same hospitalization; incident CRAB was a patient's first CRAB infection or colonization. Patients' demographic characteristics, diagnoses, treatments, disposition, and COVID-19 status were collected from medical records. Diagnoses of CRAB infection or colonization were determined by infectious disease specialists. NJDOH began an investigation to assess IPC practices at hospital A and gather additional data. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

During February–July 2020, 34 patients with hospital-acquired CRAB infection or colonization were identified, including 28 (82%) whose incident CRAB infection or colonization occurred during the facility's surge in COVID-19 cases (March–June 2020) (Figure), and 17 (50%) who had confirmed infection with SARS-CoV-2, the virus that causes COVID-19 (Table). Twenty (59%) incident cases were identified from clinical specimens and 14 (41%) through colonization screening. Median age of patients with CRAB infection was 55 years (interquartile range [IQR] = 48–64 years), and 28 patients (82%) were admitted from home. No patients had prior documented CRAB infection or colonization. The median interval from admission to incident CRAB infection was 19 days (IQR = 11–28 days). Twenty-five (74%) patients were intubated and mechanically ventilated at the time of specimen collection; those with COVID-19 were placed in a prone position. CRAB infection was diagnosed in 20 (59%) of the 34 patients, including 14 (41%) with clinically diagnosed CRAB ventilator-associated pneumonia, four of whom had bacteremia. At the time of this report, 23 (68%) patients with CRAB infection had been discharged, 10 (29%) had died, and one remained hospitalized.

The multidrug-resistant CRAB definition (*A. baumannii* with documented resistance to three or more classes of antibiotics) was applied to hospital clinical laboratory antimicrobial susceptibility data for incident cases (*4*); all 34

* 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE. Number of admitted patients with COVID-19 (N = 846) and hospital-acquired carbapenem-resistant *Acinetobacter baumannii* (CRAB)* (N = 34), by month — hospital A, New Jersey, February–July 2020



Abbreviation: COVID-19 = coronavirus disease 2019.
* CRAB infection or colonization.

met multidrug-resistant CRAB criteria. Thirty isolates were further evaluated for carbapenemase genes through real-time polymerase chain reaction testing.[†] Twenty-six isolates harbored the gene encoding the OXA-23 carbapenemase. Among these isolates, two from specimens collected in February and March harbored an additional carbapenemase gene, encoding New Delhi metallo-β-lactamase (a gene rarely present in CRAB isolates from patients in the United States), indicating that at least one CRAB introduction occurred before the surge of COVID-19 cases (*5*). Four specimens were nonviable or did not yield CRAB growth.

During March–August 2020, hospital A admitted approximately 850 patients with COVID-19. The number of cases peaked on April 9, with 36 new hospitalizations and 61% of the inpatient census having a diagnosis of confirmed or suspected COVID-19. Pandemic-related resource challenges necessitated intentional changes to IPC measures. Before the pandemic, ventilator circuits and suctioning catheters were changed at specified intervals of every 14 days and every 3 days, respectively, unless malfunctioning or visibly soiled. To conserve equipment during the surge, the hospital's respiratory therapy unit instituted a policy to extend the use of ventilator circuits and suctioning catheters for individual patients, replacing them only if they were visibly soiled or malfunctioning. To conserve PPE, gown use as part of Contact Precautions[§] was suspended for care of patients with the endemic MDROs vancomycin-resistant *Enterococcus* spp. and methicillin-resistant *Staphylococcus aureus*[¶] but was maintained for nonendemic MDROs such as CRAB. Gowns and gloves continued to be used for all patients when indicated for Standard Precautions,

[†] Real-time polymerase chain reaction testing for carbapenemase genes was performed at the Clinical Laboratory Improvement Amendments (CLIA)–certified Northeast Regional Antimicrobial Resistance Laboratory located at the Wadsworth Center at the David Axelrod Institute in Albany, New York.

[§] https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html#anchor_1564057963.

[¶] https://www.nj.gov/health/cd/documents/topics/NCOV/COVID_ppe_for_mdro_patients.pdf.

including wearing a gown when skin or clothing was likely to be exposed to blood or body fluids.** Anticipating shortages, hospital A also adopted an extended-use PPE protocol for N95 respirators and face shields. To prioritize personnel resources, activities of the MDRO workgroup, a multidisciplinary team responsible for guiding IPC policy around MDRO prevention efforts at hospital A, were suspended, along with biweekly bedside central venous catheter and indwelling urinary catheter maintenance rounds. Routine audits of appropriate PPE use, hand hygiene compliance, and environmental cleaning were also temporarily discontinued.

Responding to COVID-19–related care needs also resulted in other unintentional changes in standard practices for preventing the spread of MDROs and device-associated infections. IPC leadership noted less frequent patient bathing with chlorhexidine gluconate and a 43% reduction in ICU CRAB screening tests. These changes resulted from competing clinical priorities, challenges in personnel availability, and an effort to minimize staff members' interaction time with patients. The facility experienced critical shortages in personnel for nursing and environmental services, resulting from staff members' illness, quarantine, and a surge in the number of patients with COVID-19. Nursing resources were supplemented through agency and government entities; however, increased patient-to-staff member ratios and the need to minimize patient contact might have led to unidentified IPC breaches.

In early May, hospital A's IPC leadership advised physicians, unit managers, and environmental services of the CRAB cluster. Environmental services cleaned common areas and high-touch surfaces of ICUs with bleach. Proper hand hygiene and PPE use were reinforced through unit-based education, and compliance audits were restarted by mid-May. At the end of May, environmental services terminally cleaned and disinfected the COVID-19 dedicated ICUs and associated portable medical and respiratory equipment. IPC personnel and unit leadership reinforced CRAB surveillance culture protocol adherence.

TABLE. Demographic and clinical characteristics of patients with carbapenem-resistant *Acinetobacter baumannii* (CRAB) (N = 34) — hospital A, New Jersey, February–July 2020

Characteristics of patients with CRAB	No. (%) of patients
Age, median (IQR), yrs	55 (48–64)
Sex	
Male	24 (71)
Female	10 (29)
Location before admission	
Home	28 (82)
Skilled nursing facility	5 (15)
Long-term acute care hospital	1 (3)
Collection location of incident CRAB	
Intensive care unit	25 (73)
Medical-surgical unit	5 (15)
Progressive care or step-down unit	4 (12)
Specimen source of incident CRAB	
Respiratory (sputum, tracheal aspirate, or bronchial)	17 (50)
Axilla, groin, or rectal	6 (18)
Blood	5 (15)
Wound, bone, or other tissue	4 (12)
Urine	2 (5)
SARS-CoV-2 status	
Positive	17 (50)
Negative	17 (50)
CRAB infection/colonization	
Ventilator-associated pneumonia	10 (29)
Ventilator-associated pneumonia with bacteremia	4 (12)
Bacteremia	3 (9)
Bone or soft tissue infection	3 (9)
Colonization	14 (41)
Intubation/Mechanical ventilation at time of incident CRAB	
Yes	25 (74)
No	7 (21)
Tracheostomy	
Yes	8 (24)
No	26 (76)
Received respiratory therapy services	
Yes	28 (82)
No	6 (18)
Disposition	
Discharged/Transferred	23 (68)
Deceased	10 (29)
Remains hospitalized	1 (3)

Abbreviation: IQR = interquartile range

Public Health Response

In collaboration with hospital A, NJDOH investigated the cluster, including review of laboratory data, patient information, IPC policies, and audit tools. NJDOH provided technical guidance on IPC interventions and advised returning to normal operations as soon as capacity allowed. IPC processes and interventions developed in collaboration with NJDOH (adapted from CDC guidelines††) during a previous CRAB outbreak at hospital A helped establish metrics for baseline incident case counts and adherence to IPC-related measures.

In June, NJDOH used New Jersey's public health notification system§§ to alert public health officials, health care providers, and infection preventionists to the possible resurgence of MDROs in health care facilities facing COVID-19–related resource limitations. In June 2020, hospital A reported fewer incident hospital-associated CRAB cases, coinciding with a sharp decrease in COVID-19 hospitalizations (Figure). This trend continued through July. In August, no incident hospital-associated CRAB cases were reported, signaling a return to baseline numbers for the facility.

** https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html.
†† https://www.cdc.gov/infectioncontrol/guidelines/mdro/index.html.
§§ https://www.njlincs.net/PublicHealthAlertMessages/messageviewer.aspx?id=110407.

Summary

What is already known about this topic?

Carbapenem-resistant *Acinetobacter baumannii* (CRAB) causes health care–associated infections that are challenging to contain and often linked to infection prevention and control (IPC) breaches.

What is added by this report?

A New Jersey hospital reported a cluster of 34 CRAB cases that peaked during a surge in COVID-19 hospitalizations. Strategies to preserve continuity of care led to deviations in IPC practices; CRAB cases decreased when normal operations resumed.

What are the implications for public health practice?

Hospitals managing surges of patients with COVID-19 might be vulnerable to outbreaks of multidrug-resistant organism (MDRO) infections. Maintaining IPC best practices (e.g., MDRO surveillance and hand hygiene and environmental cleaning audits) to the extent possible could mitigate spread.

Discussion

The impact of the COVID-19 pandemic on the spread of antibiotic resistance in health care settings has not been fully described. In response to a rapid increase in SARS-CoV-2 infections, many health care facilities adopted mitigation strategies to contend with physical space limitations, constrained availability of personnel, shortages in PPE, and a large number of critically ill patients. Recent single-facility reports from the United States and Europe have described increased acquisition of MDROs among patients hospitalized with COVID-19 (*6*–*8*). Hospital A experienced a large multidrug-resistant CRAB outbreak, primarily involving ICU patients, which extended across multiple units during a surge in COVID-19 cases.

Outbreaks of CRAB have been well documented in acute care hospitals, particularly among critically ill patients, and are often driven by factors that include breaches in infection control and persistent environmental contamination (*3*,*9*). Containing these outbreaks often requires multiple, targeted interventions, including increased surveillance, IPC audits, and environmental cleaning (*10*). During COVID-19 preparations and the ensuing surge in cases, decreased vigilance for control of CRAB transmissions, including suspension of the MDRO workgroup, reduced surveillance cultures, reduced personnel numbers (which decreased capacity for overall auditing practices), and both intentional and unintentional changes in IPC practice likely contributed to this CRAB cluster. The lack of audits made identifying and correcting real-time IPC compliance issues difficult. Diminished colonization screening might have resulted in a higher threshold for recognizing increasing incident hospital-acquired CRAB cases. Reinstatement of conventional IPC strategies in ICUs, paired with enhanced cleaning procedures and hand hygiene reeducation, likely contributed to the rapid decline in cases.

The findings in this report are subject to at least three limitations. First, CRAB can colonize persons for long periods, possibly leading to misclassification of some cases present at admission as hospital-acquired cases; decreased ICU surveillance testing might have contributed to this misclassification. Second, objective assessment of hand hygiene, PPE use, and environmental cleaning during the surge in COVID-19 cases is difficult without routine audit data. Finally, whole genome sequencing to determine the relatedness of isolates was not performed. Carbapenem resistance mechanism testing indicated at least two introductions of CRAB, including one preceding the surge. Whether OXA-23 CRAB spread into distinct patient populations (i.e., patients with and without COVID-19) or these were different introductions remains unclear.

The COVID-19 pandemic has required hospitals to take unprecedented measures to maintain continuity of patient care and protect health care personnel from infection. This outbreak highlights that MDROs can spread rapidly in hospitals experiencing surges in COVID-19 cases and cause serious infections in this setting. To reduce spread of MDROs and the risk of infection for patients, hospitals should remain vigilant to prevent and detect clusters of unusual infections and respond promptly when they are detected. Facilities should prioritize continuity of core IPC practices (e.g., training for and auditing of hand hygiene, PPE use, and environmental cleaning) to the greatest extent possible during surges in hospitalizations and make every effort to return to normal operating procedures as soon as capacity allows.

Acknowledgments

Christina Tan, Barbara Montana, Edward Lifshitz, Communicable Disease Service, New Jersey Department of Health; Alicia Shugart, Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Elizabeth Nazarian, Wadsworth Center, New York State Department of Health; staff members and patients of hospital A.

Corresponding author: Stephen Perez, okm9@cdc.gov.

[1]Epidemic Intelligence Service, CDC; [2]Communicable Disease Service, New Jersey Department of Health; [3]Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [4]New Jersey Medical School, Rutgers University, Newark, New Jersey.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. CDC. Antibiotic resistance threats in the United States 2019. Atlanta, GA: US Department of Health and Human Services, CDC; 2019.
2. Chen CH, Lin LC, Chang YJ, Chen YM, Chang CY, Huang CC. Infection control programs and antibiotic control programs to limit transmission of multi-drug resistant *Acinetobacter baumannii* infections: evolution of old problems and new challenges for institutes. Int J Environ Res Public Health 2015;12:8871–82. PMID:26264006 https://doi.org/10.3390/ijerph120808871
3. Gootz TD, Marra A. *Acinetobacter baumannii*: an emerging multidrug-resistant threat. Expert Rev Anti Infect Ther 2008;6:309–25. PMID:18588496 https://doi.org/10.1586/14787210.6.3.309
4. Magiorakos A-P, Srinivasan A, Carey RB, et al. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clin Microbiol Infect 2012;18:268–81. PMID:21793988 https://doi.org/10.1111/j.1469-0691.2011.03570.x
5. CDC. Healthcare-associated infections: tracking CRE in the United States. Atlanta, GA: US Department of Health and Human Services, CDC; 2019. https://www.cdc.gov/hai/organisms/cre/trackingcre.html
6. Porretta AD, Baggiani A, Arzilli G, et al. Increased risk of acquisition of New Delhi metallo-beta-lactamase-producing carbapenem-resistant Enterobacterales (NDM-CRE) among a cohort of COVID-19 patients in a teaching hospital in Tuscany, Italy. Pathogens 2020;9:635. PMID:32764228 https://doi.org/10.3390/pathogens9080635
7. Tiri B, Sensi E, Marsiliani V, et al. Antimicrobial stewardship program, COVID-19, and infection control: spread of carbapenem-resistant *Klebsiella pneumoniae* colonization in ICU COVID-19 patients. What did not work? J Clin Med 2020;9:2744. PMID:32854334 https://doi.org/10.3390/jcm9092744
8. Nori P, Szymczak W, Puius Y, et al. Emerging co-pathogens: New Delhi metallo-beta-lactamase producing Enterobacterales infections in New York City COVID-19 patients. Int J Antimicrob Agents 2020;56:106179. PMID:32987104 https://doi.org/10.1016/j.ijantimicag.2020.106179
9. Ben-Chetrit E, Wiener-Well Y, Lesho E, et al. An intervention to control an ICU outbreak of carbapenem-resistant *Acinetobacter baumannii*: long-term impact for the ICU and hospital. Crit Care 2018;22:319. PMID:30463589 https://doi.org/10.1186/s13054-018-2247-y
10. Tomczyk S, Zanichelli V, Grayson ML, et al. Control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii*, and *Pseudomonas aeruginosa* in healthcare facilities: a systematic review and reanalysis of quasi-experimental studies. Clin Infect Dis 2019;68:873–84. PMID:30475989 https://doi.org/10.1093/cid/ciy752

Notes from the Field

Interpretation of Rapid Diagnostic Tests for Leptospirosis During a Dengue Outbreak — Yap State, Federated States of Micronesia, 2019

Patrick Dawson, PhD[1,2]; Maria Marfel[3]; Renee Galloway, MPH[2]; Aileen Tareg, DrPH[3]; Gabriela Paz-Bailey, MD, PhD[4]; Jorge L. Muñoz-Jordán, PhD[4]; Tyler M. Sharp, PhD[4]; Laura E. Adams, DVM[4]; William A. Bower, MD[2]

On August 30, 2019, Yap State declared a public health crisis caused by concurrent outbreaks of dengue and leptospirosis, two clinically similar illnesses, resulting in 545 suspected dengue cases and 515 suspected leptospirosis cases during January–August 2019. Dengue virus type 3 (DENV-3) was identified by reverse transcription–polymerase chain reaction (RT-PCR) for 38 patients. Leptospirosis is endemic in Yap State (pop. approximately 11,500) with an anecdotal baseline of 0–2 cases/month.* Dengue is a potentially fatal mosquito-borne acute febrile viral illness (*1*). Leptospirosis is caused by infection with *Leptospira* bacteria and commonly acquired from contact with water or soil contaminated with infected animal urine (*2*). Approximately 90% of patients with leptospirosis experience self-limiting acute febrile illness, and 10% develop severe, potentially life-threatening illness (*3*). Early antibiotic treatment is generally associated with less severe and shorter illness (*4*). A team of outbreak investigators from Yap State and CDC identified suspected dengue and leptospirosis cases among patients with dengue-like illness (DLI),† which is clinically compatible with both illnesses. The majority of patients with DLI were reported and tested as having suspected cases of both dengue and leptospirosis during the outbreak.

Among 515 patients with DLI tested for leptospirosis, 115 (22%) had a positive immunoglobulin M (IgM) leptospirosis rapid diagnostic test (LRDT) result.§ Because anti-*Leptospira* IgM antibodies can persist ≥12 months postinfection (*5*), the team performed testing to confirm the LRDT results and assess whether a leptospirosis outbreak occurred during the dengue outbreak.

During May–September 2019, the team collected paired acute-phase and convalescent-phase sera from patients¶ with DLI. Sera were tested for evidence of dengue by RT-PCR and enzyme-linked immunosorbent assay (ELISA)** at CDC and for leptospirosis by LRDT in Yap State and microscopic agglutination test (MAT), the serodiagnostic reference standard, at CDC. A laboratory-confirmed acute leptospirosis case was defined as a ≥fourfold increase in reciprocal MAT titers or any reciprocal MAT titer ≥800.†† The team calculated the LRDT's performance characteristics and 95% confidence intervals (CIs).

Sera were tested from 103 patients, of whom 98 had paired sera. Forty-four patients (43%) tested positive for dengue by RT-PCR (40 patients) or ELISA (four). Five patients (5%) met the leptospirosis case definition; one patient seroconverted to a convalescent titer of 200, and four patients had titers ≥800 that did not change between acute and convalescent specimens, suggesting recent exposure (<6 months) but not acute infection. In addition, two of these four patients tested positive for DENV-3 by RT-PCR. An additional 11 patients (11%) had at least one titer ≥200 but <800 and lacked a ≥fourfold increase. Among 91 patients with LRDT and MAT results, 33 (36%) were LRDT-positive, including the five with confirmed cases (Table). The LRDT had a low positive predictive value of 15% (95% CI = 7%–31%) compared with MAT confirmation.

Testing performed at CDC confirmed the occurrence of a dengue outbreak in Yap State but did not support the occurrence of a leptospirosis outbreak because the number and frequency of confirmed cases were within the anecdotal baseline. The LRDT likely detected previous *Leptospira* exposures in most patients with positive results. During an outbreak of acute febrile illness in a leptospirosis-endemic area, health officials should consider the possibility of prolonged IgM detection when interpreting LRDTs. However, if leptospirosis is clinically suspected, antibiotic treatment should be initiated immediately. The recent experience in Yap State highlights the need for an antigen-based LRDT (i.e., alternative to antibody detection) and local capacity for PCR-based molecular diagnostics. Furthermore, the current case definition for laboratory-confirmed acute leptospirosis of any MAT titer ≥800 might not be appropriate for endemic areas because of the persistence of antibodies in the population.

* The anecdotal baseline was based on hospital staff member recall (there is only one hospital in Yap) of the frequency of positive anti-*Leptospira* rapid diagnostic tests for patients with clinically compatible symptoms in the absence of a dengue outbreak.

† Dengue-like illness was defined as fever and two or more of the following: nausea/vomiting, rash, aches and pains, any severe dengue warning sign (persistent vomiting, abdominal pain or tenderness, clinical fluid accumulation, mucosal bleeding, or lethargy/restlessness).

§ SD Bioline *Leptospira* IgM, Abbott Laboratories. https://www.globalpointofcare.abbott/en/product-details/sd-bioline-leptospira.html.

¶ Patients were from Yap Memorial Hospital and four Wa'ab Community Health Center clinics in the Yap Main Islands.

** DENV Detect IgM Capture ELISA, InBios International. https://inbios.com/denv-detecttm-igm-capture-elisa-kit-intl/.

†† https://wwwn.cdc.gov/nndss/conditions/leptospirosis/case-definition/2013/.

TABLE. Comparison of anti-*Leptospira* immunoglobulin M rapid diagnostic test (LRDT) results with leptospirosis microscopic agglutination test (MAT) results among patients with dengue-like illness* during a dengue outbreak — Yap State, Federated States of Micronesia, 2019

Result	MAT positive†	MAT negative§	Total
LRDT positive	5	28	33
LRDT negative	0	58	58
Total	**5**	**86**	**91**
LRDT performance characteristic		**%**	**(95% CI)**
Sensitivity		100	(57–100)
Specificity		67	(57–76)
Positive predictive value		15	(7–31)
Negative predictive value		100	(94–100)

Abbreviation: CI = confidence interval.

* Dengue-like illness was defined as fever with two or more of the following: nausea/vomiting, rash, aches and pains, any severe dengue warning sign (persistent vomiting, abdominal pain or tenderness, clinical fluid accumulation, mucosal bleeding, or lethargy/restlessness).

† Criteria for a positive leptospirosis MAT result were a ≥4-fold increase in reciprocal MAT titers or any reciprocal MAT titer ≥800.

§ Results were considered MAT negative if there was a <4-fold increase in reciprocal MAT titers and all reciprocal titers were <800.

Corresponding author: Patrick Dawson, wpb7@cdc.gov, 404-718-3628.

[1]Epidemic Intelligence Service, CDC; [2]Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [3]Yap State Department of Health Services, Federated States of Micronesia; [4]Division of Vector-Borne Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. World Health Organization. Dengue: guidelines for diagnosis, treatment, prevention and control. Geneva, Switzerland: World Health Organization; 2009. https://www.who.int/tdr/publications/documents/dengue-diagnosis.pdf
2. CDC. Leptospirosis infection. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. https://www.cdc.gov/leptospirosis/infection/index.html
3. American Academy of Pediatrics. Leptospirosis. In: Kimberlin DW, Barady MT, Jackson MA, Long SS, eds. Red book: 2018 report of the Committee on Infectious Diseases. 31st ed. Itasca, IL: American Academy of Pediatrics; 2018:508–11.
4. McClain JBL, Ballou WR, Harrison SM, Steinweg DL. Doxycycline therapy for leptospirosis. Ann Intern Med 1984;100:696–8. PMID:6712032 https://doi.org/10.7326/0003-4819-100-5-696
5. Silva MV, Camargo ED, Batista L, et al. Behaviour of specific IgM, IgG and IgA class antibodies in human leptospirosis during the acute phase of the disease and during convalescence. J Trop Med Hyg 1995;98:268–72. PMID:7636924

Errata

Vol. 63, No. SS-11

In the Surveillance Summary "Abortion Surveillance — United States, 2011," data on the number of known previous induced abortions for women having abortions in this reporting year were erroneously included for New York City. These data did not meet reporting standards and should have been excluded from this report. When corrected, among women with abortions in the reporting year, the proportion with no previous induced abortions increased, and the proportion with one or more previous induced abortions decreased.

On page 8, the first paragraph should have read "Data from the **37** areas that reported the number of previous abortions for women who obtained abortions in 2011 indicate that the majority (**56.9%**) had no previous abortions, **36.1%** had one to two previous abortions, and **7.1%** had three or more previous abortions (Table 19). Among the **30** reporting areas¶¶¶¶ that provided data for the relevant years of comparison (2002 versus 2006, 2007 versus 2011, and 2010 versus 2011), the percentage of women who had one to two previous abortions was stable, although there was a decrease among women who had zero previous abortions and an increase among women who had three or more previous abortions. Among the areas included in this comparison, **57.8%**, **36.0%**, and **6.2%** of women had zero, one to two, or three or more previous abortions, respectively, in 2002; by contrast, **57.0%**, **35.9%**, and **7.2%** of women had zero, one to two, or three or more previous abortions, respectively, in 2011." New York City should have been included in the ¶¶¶¶ footnote, which lists reporting areas that were not included in these estimates.

In Table 19, the line for New York City should be deleted. For the total line, the numbers and percentages should have read **229,909 (56.9), 102,612 (25.4), 43,159 (10.7), 28,593 (7.1), 404,273 (97.8)**. The * footnote should have read "Data from **37** reporting areas; excludes **15** areas (California, Connecticut, District of Columbia, Florida, Georgia, Illinois, Maryland, New Hampshire, New Mexico, **New York City**, New York State, North Carolina, Vermont, Wisconsin, and Wyoming) that did not report, did not report by the number of previous induced abortions, or did not meet reporting standards." The total in the ** footnote should have been **413,504**.

Vol. 64, No. SS-10

In the Surveillance Summary "Abortion Surveillance — United States, 2012," data on the number of known previous induced abortions for women having abortions in this reporting year were erroneously included for New York City. These estimates did not meet reporting standards and should have been excluded from this report. When corrected, among women with abortions in the reporting year, the proportion with no previous induced abortions increased, and the proportion with one or more previous induced abortions decreased.

On page 9, the last paragraph of the first column should have read "Data from the **37** areas that reported the number of previous abortions for women who obtained abortions in 2012 indicate that the majority (**58.4%**) had no previous abortions, **34.9%** had one to two previous abortions, and **6.7%** had three or more previous abortions (Table 17). Among the **30** reporting areas††††† that provided data for the relevant years of comparison (2003 versus 2007, 2008 versus 2012, and 2011 versus 2012), the percentage of women who had zero or one to two previous abortions was comparatively stable; there was an increase from 2003 to 2012 in the percentage of women who had three or more previous abortions, but the percentages leveled off from 2011 to 2012. Among the areas included in this comparison, **58.0%**, **35.6%**, and **6.4%** of women had zero, one to two, or three or more previous abortions, respectively, in 2003; by contrast, **57.0%**, **35.8%**, and **7.2%** of women had zero, one to two, or three or more previous abortions, respectively, in 2011, and **57.6%**, **35.3%**, and **7.2%** of women had zero, one to two, or three or more previous abortions, respectively, in 2012." New York City should have been included in the ††††† footnote, which lists reporting areas that were not included in these estimates.

In Table 17, the line for New York City should be deleted. For the total line, the numbers and percentages should have read **251,973 (58.4), 106,457 (24.7), 43,920 (10.2), 28,902 (6.7), 431,252 (96.8)**. The * footnote should have read "Data from **37** reporting areas; excludes **15** areas (California, Connecticut, District of Columbia, Florida, Hawaii, Illinois, Maine, Maryland, New Hampshire, New Mexico, **New York City**, New York State, Vermont, Wisconsin, and Wyoming) that did not report, did not report by the number of previous induced abortions, or did not meet reporting standards." The total in the ** footnote should have been **445,363**.

Errata

Vol. 65, No. SS-12

In the Surveillance Summary "Abortion Surveillance — United States, 2013," data on the number of known previous induced abortions for women having abortions in this reporting year were erroneously included for New York City. These estimates did not meet reporting standards and should have been excluded from this report. When corrected, among women with abortions in the reporting year, the proportion with no previous induced abortions increased, and the proportion with one or more previous induced abortions decreased. In addition, Nebraska was erroneously excluded as a reporting area for the relevant years of comparison for estimates on reported abortions, by known number of previous induced abortions. Data have been updated to include Nebraska.

On page 9, the last paragraph of the first column should have read "Data from the **38** areas that reported the number of previous abortions for women who obtained abortions in 2013 indicate that the majority (**57.7%**) had no previous abortions, **35.5%** had one to two previous abortions, and **6.8%** had three or more previous abortions (Table 17). Among the 30 reporting areas§§§§ that provided data for the relevant years of comparison (2004 to 2013, 2004 versus 2008, 2009 versus 2013, and 2012 versus 2013), the percentage of women who had zero or one to two previous abortions did not change appreciably over time: **57.8%**, **58.2%**, and **58.1%** had zero previous abortions in 2004, 2012, and 2013, respectively, and **35.9%**, **34.9%**, and **35.0%** had one to two previous abortions in 2004, 2012, and 2013, respectively. In contrast, among these 30 areas, the percentage of women who had three or more previous abortions increased from 2004 to 2013 but did not change appreciably from 2012 to 2013: **6.3%** had three or more previous abortions in 2004, as compared with **6.8%** in 2012 and **6.8%** in 2013." New York City should have been included, and Nebraska should not have been included in the §§§§ footnote, which lists reporting areas that were not included in these estimates.

In Table 17, the line for New York City should be deleted. For the total line, the numbers and percentages should have read **213,976 (57.7), 92,992 (25.1), 38,551 (10.4), 25,291 (6.8), 370,810 (98.7)**. The * footnote should have read "Data from **38** reporting areas; excludes **14** areas (California, Connecticut, District of Columbia, Florida, Georgia, Illinois, Maryland, New Hampshire, New Mexico, **New York City**, New York State, North Carolina, Wisconsin, and Wyoming) that did not report, did not report by the number of previous induced abortions, or did not meet reporting standards." The total in the ** footnote should have been **375,638**.

Vol. 66, No. SS-25

In the Surveillance Summary "Abortion Surveillance — United States, 2014," data on the number of known previous induced abortions for women having abortions in this reporting year were erroneously included for New York City. These estimates did not meet reporting standards and should have been excluded from this report. When corrected, among women with abortions in the reporting year, the proportion with no previous induced abortions increased, and the proportion with one or more previous induced abortions decreased.

On page 2, the second and third sentences of the second paragraph should have read "Women with one or more previous induced abortions accounted for **42.5%** of abortions, and women with no previous abortion accounted for **57.5%**. Women with three or more previous births accounted for 13.8% of abortions, and women with three or more previous abortions accounted for **7.0%** of abortions."

On page 10, the first paragraph should have read "Data from the **39** areas that reported the number of previous abortions for women who obtained abortions in 2014 indicate that the majority (**57.5%**) had no previous abortions, **35.5%** had one to two previous abortions, and **7.0%** had three or more previous abortions (Table 17). Among the **32** reporting areas§§§§ that provided data for the relevant years of comparison (2005 to 2014, 2005 versus 2009, 2010 versus 2014, and 2013 versus 2014), the percentage of women who had zero or one to two previous abortions did not change substantially over time, but the percentage of women who had three or more previous abortions increased from 2005 to 2014. Among the areas included in this comparison, **57.9%**, **35.6%**, and **6.4%** of women had zero, one to two, or three or more previous abortions, respectively, in 2005; **58.3%**, **35.1%**, and **6.6%** of women had zero, one to two, or three or more previous abortions, respectively, in 2014." New York City should have been included in the §§§§ footnote, which lists reporting areas that were not included in these estimates.

In Table 17, the line for New York City should be deleted. For the total line, the numbers and percentages should have read **224,737 (57.5), 97,093 (24.8), 41,871 (10.7), 27,256 (7.0), 390,957 (98.5)**. The * footnote should have read "Data from **39** reporting areas; excludes **13** areas (California, Connecticut, District of Columbia, Florida, Illinois, Maryland, New Hampshire, New Mexico, **New York City**, New York State, North Carolina, Wisconsin, and Wyoming) that did not report, did not report by the number of previous induced abortions, or did not meet reporting standards." The total in the ** footnote should have been **397,042**.

Erratum

Vol. 67, No. SS-13

In the Surveillance Summary "Abortion Surveillance — United States, 2015," data on the number of known previous induced abortions for women having abortions in this reporting year were erroneously included for New York City. These estimates did not meet reporting standards and should have been excluded from this report. When corrected, among women with abortions in the reporting year, the proportion with no previous induced abortions increased, and the proportion with one or more previous induced abortions decreased.

On page 2, the second and third sentences of the second paragraph should have read "Women with one or more previous induced abortions accounted for **41.0%** of abortions, and women with no previous abortion accounted for **59.0%**. Women with three or more previous births accounted for 14.2% of abortions, and women with three or more previous abortions accounted for **6.5%** of abortions."

On page 8, the last paragraph of the second column should have read "Data from the **38** areas that reported the number of previous abortions for women who obtained abortions in 2015 indicate that the majority (**59.0%**) had no previous abortions, **34.5%** had one or two previous abortions, and **6.5%** had three or more previous abortions (Table 17). Among the **34** reporting areas††††† that provided data for the relevant years of comparison (2006 versus 2015, 2006 versus 2010, 2011 versus 2015, and 2014 versus 2015), the percentage of women who had no previous abortions increased **2%** (from **57.8% to 59.1%**), whereas there was a **4%** decrease for women who had one or two previous abortions, **and the percentage of women who had three or more previous abortions was unchanged (6.4%)** from 2006 to 2015. However, the percentage of women who had no previous abortions decreased 1% from 2006 to 2010 (from **57.8% to 57.4%**) and then increased **3%** from 2011 to 2015 (from **57.2% to 59.1%**). By contrast, the percentage of women who had three or more previous abortions increased **11.0%** from 2006 to 2010 (from **6.4% to 7.1%**) then decreased 9% from 2011 to 2015 (from **7.0% to 6.4%**). The percentage of women who had one or two previous abortions remained stable from 2006 to 2010 (**35.7% to 35.6%**) and then decreased 4% from 2011 to 2015 (from **35.8% to 34.4%**)." New York City should have been included in the ††††† footnote, which lists reporting areas that were not included in these estimates.

In Table 17, the line for New York City should be deleted. For the total line, the numbers and percentages should have read **224,163 (59.0), 93,025 (24.5), 37,923 (10.0), 24,519 (6.5), 379,630 (99.4)**. The * footnote should have read "Data from **38** reporting areas; excludes **14** areas (California, Connecticut, District of Columbia, Florida, Hawaii, Illinois, Maryland, New Hampshire, New Mexico, **New York City**, New York State, North Carolina, Wisconsin, and Wyoming) that did not report, did not report by the number of previous induced abortions, or did not meet reporting standards." The total in the ** footnote should have been **382,003**.

Erratum

Vol. 68, No. SS-11

In the Surveillance Summary "Abortion Surveillance — United States, 2016," data on the number of known previous induced abortions for women having abortions in this reporting year were erroneously included for New York City. These estimates did not meet reporting standards and should have been excluded from this report. When corrected, among women with abortions in the reporting year, the proportion with no previous induced abortions increased, and the proportion with one or more previous induced abortions decreased.

On page 2, the second sentence of the first paragraph should have read "Women with one or more previous induced abortions accounted for **40.7%** of abortions, and women with no previous abortions accounted for **59.4%**."

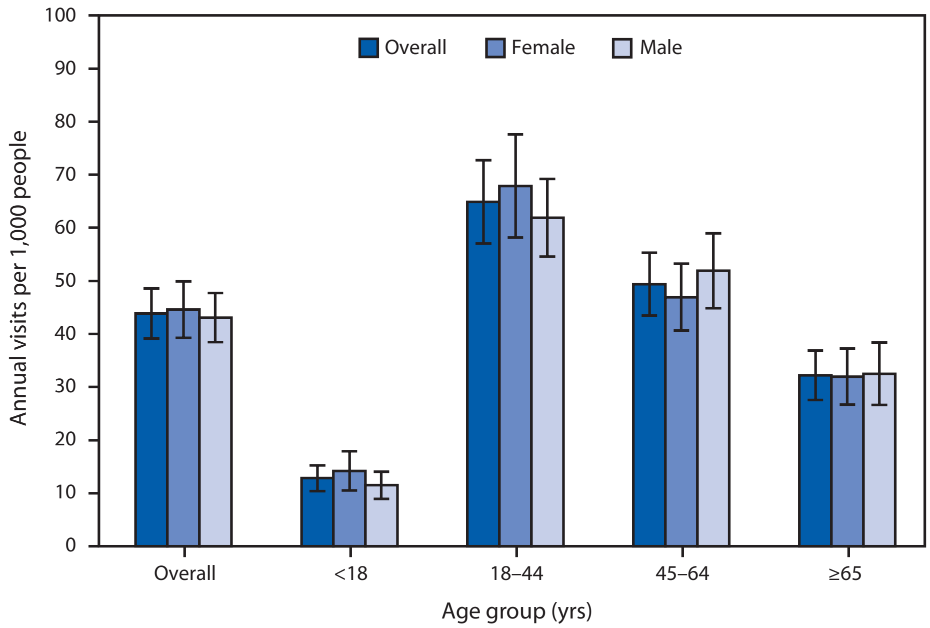
On page 10, the first paragraph of the first column should have read "Data from the **41** areas that reported the number of previous abortions for women who obtained abortions in 2016 indicate that the majority (**59.4%**) had no previous abortions, **34.4%** had one or two previous abortions, and **6.3%** had three or more previous abortions (Table 17). Among the **34** reporting areas***** that provided data for the relevant years of comparison (2007 versus 2016, 2007 versus 2011, 2012 versus 2016, and 2015 versus 2016), the percentage of women who had no previous abortions increased **3%** (from **57.4% to 59.1%**), whereas a **4%** decrease occurred among women who had one or two previous abortions, and a 4% **decrease** occurred among women who had three or more previous abortions from 2007 to 2016. However, the percentage of women who had no previous abortions decreased **1%** from 2007 to 2011 (from **57.4% to 56.8%**) and then increased 3% from 2012 to 2016 (from **57.6% to 59.1%**). By contrast, the percentage of women who had three or more previous abortions increased **4%** from 2007 to 2011 (from **6.8% to 7.1%**) then decreased **6%** from 2012 to 2016 (from **6.9% to 6.5%**). The percentage of women who had one or two previous abortions increased **1%** from 2007 to 2011 (**35.8% to 36.1%**) and then decreased **3%** from 2012 to 2016 (from **35.5% to 34.5%**)." New York City should have been included in the ***** footnote, which lists reporting areas that were not included in these estimates.

In Table 17, the line for New York City should be deleted. For the total line, the numbers and percentages should have read **244,362 (59.4), 100,248 (24.4), 40,972 (10.0), 25,986 (6.3), 411,568 (98.5)**. The * footnote should have read "Data from **41** reporting areas; excludes **11** areas (California, District of Columbia, Florida, Illinois, Maryland, New Hampshire, New Mexico, **New York City**, New York State, Wisconsin, and Wyoming) that did not report, did not report by the number of previous induced abortions, or did not meet reporting standards." The total in the ** footnote should have been **417,809**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Emergency Department Visit Rates* Related to Mental Health Disorders,† by Age Group and Sex — National Hospital Ambulatory Medical Care Survey, United States,§ 2016–2018



* Visit rates are based on the July 1, 2016–July 1, 2018, estimates of the civilian noninstitutionalized population as developed by the U.S. Census Bureau Population Division; 95% confidence intervals are indicated with error bars.

† Visits related to mental health disorder are defined as all emergency department visits with any listed diagnosis of a mental health disorder, *International Classification of Diseases, Tenth Revision*, *Clinical Modification* codes F01–F99.

§ Based on a sample of visits to emergency departments in noninstitutional general and short-stay hospitals, exclusive of federal, military, and Veterans Administration hospitals, that are located in the 50 states and the District of Columbia.

During 2016–2018, there were 43.9 emergency department visits per 1,000 persons per year with a diagnosis of a mental health disorder. Rates were lowest among children and adolescents aged <18 years (12.8) and highest for adults aged 18–44 years (64.9). Rates declined with age for adults aged 18–44 to ≥65 years (32.2). Overall and for each age group, there were no statistically significant differences by sex.

Source: National Center for Health Statistics. National Hospital Ambulatory Medical Care Survey, 2016–2018. https://www.cdc.gov/nchs/ahcd/ahcd_questionnaires.htm.

Reported by: Loredana Santo, MD, lsanto@cdc.gov, 301-458-4122; Zachary Peters, MPH; Carol DeFrances, PhD.

ISSN: 0149-2195 (Print)