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Racial/Ethnic Disparities in Infectious Disease Hospitalizations in Arizona

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ABSTRACT

Infectious disease (ID) hospitalizations in Arizona, a diverse population with nearly complete race/ethnicity data, were analyzed using the State Inpatient Database for 2005-2008. ID hospitalizations rates were calculated and compared by ID group, race/ethnicity, age, and sex. During 2005-2008, there were 383,597 ID hospitalizations reported in Arizona, resulting in an age-adjusted rate of 1498.1 per 100,000 persons. A range of racial/ethnic disparities in ID hospitalization rates were noted. Persons of Native American and black race/ethnicity had overall ID hospitalization rates higher than the rate for persons of white race/ethnicity; persons of Asian or Pacific Islander race/ethnicity had a lower rate. The lower respiratory tract infection (LRTI) hospitalization rate was the highest rate of all ID groups, followed by cellulitis and septicemia. Persons of black and Native American race had higher LRTI hospitalization rates than persons of white race. Racial/ethnic disparities persist for ID hospitalizations in Arizona. Persons of Native American and black race/ethnicity experience high age-adjusted rates of ID hospitalization. Prevention efforts should focus on high risk race/ethnicity groups and disease groups.

Keywords: Arizona, infectious diseases, hospitalization, race, ethnicity, disparities

INTRODUCTION

Infectious disease (ID) mortality decreased during the 20th century, in part due to advances in medical care and vaccines, improved sanitation, and increased prevention in the spread of IDs (Armstrong, Conn and Pinner, 1999; Cohen, 2000). However, ID mortality increased in the 1980s, primarily due to the emergence of acquired immunodeficiency syndrome (AIDS) and other novel IDs (Armstrong, Conn and Pinner, 1999; Cohen, 2000). Studies have shown that IDs still account for a considerable number of hospitalizations, outpatient visits, and emergency department visits (Armstrong and Pinner, 1999; Adekoya, 2007; Christensen et al., 2009).

In the late 20th century, public health and medical professionals focused on identifiable, preventable, and avoidable differences in disease rates and their impact on different populations (U.S. Department of Health and Human Services; U.S. Department of Health and Human Services, 2000; Smedley et al., 2003; Keppel, Percy and Klein, 2004; Livingston, 2004; LaVeist and University of North Carolina at Chapel Hill. Offices of Medical Education. Center of Excellence., 2005; Centers for Disease Control and Prevention, 2011a). The persistence of health disparities has been seen as a problem for populations that experience poor health outcomes, but also as a reflection of social and economic inequalities (Centers for Disease Control and Prevention; Williams and Jackson, 2005; Braveman et al., 2010; Beckles et al., 2011; Braveman, Egerter and Mockenhaupt, 2011), presenting a serious and urgent challenge to the nation's health (Centers for Disease Control and Prevention; U.S. Department of Health and Human Services; Kicera, Douglas and Guerra, 2005; Centers for Disease Control and Prevention, 2011a; Truman et al., 2011; Metzler M et al., In Press).

Racial and ethnic disparities in ID morbidity and mortality have been shown to exist (Buehler et al., 1989; Pinner et al., 1996; Armstrong and Pinner, 1999; Richardus and Kunst, 2001; Adekoya, 2007; Christensen et al., 2009). For example, morbidity and mortality rates from human immunodeficiency virus (HIV)/AIDS in the United States are highest among black/African American, Hispanic/Latino, and Native Hawaiian/Other Pacific Islander racial/ethnic minorities (Centers for Disease Control and Prevention). Case rates of tuberculosis (TB) in the United States are highest among foreign-born persons who have immigrated from Latin America, Asia, and Africa (Cain et al., 2007; Cain et al., 2008), but are also elevated among U.S. born black and American Indian/Alaska Native (AI/AN) persons (Bloss et al., 2011; Centers for Disease Control and Prevention, 2012). Lower respiratory tract infection (LRTI) morbidity and mortality rates are higher among AI/AN children than US children (Peck et al., 2005; Singleton et al., 2012).

The persistence of racial and ethnic disparities was evident during the 2009-2010 influenza A (H1N1) virus pandemic; rates of H1N1 related hospitalizations, complications, and deaths disproportionately affected AI/ANs and persons of black and Hispanic race/ethnicity (Centers for Disease Control and Prevention; Chen et al., 2007; Centers for Disease Control and Prevention, 2009; Hutchins et al., 2009; Leon et al., 2009; Louie et al., 2009; Chitnis et al., 2010; Dee et al., 2011; Thompson et al., 2011; Uscher-Pines, Maurer and Harris, 2011; Wenger et al., 2011; Medina-Marino et al., In Press). Reasons for the disparities seen during the H1N1 pandemic remain unclear but social determinants of health such as poverty and limited and/or delayed access to care have been suggested as potential factors (Blumenshine et al., 2008; Centers for Disease Control and Prevention, 2009; Dee et al., 2011; Plough et al., 2011; Metzler M et al., In Press).

National hospitalization data are useful as a surveillance tool to monitor rates for IDs, however, national hospitalization databases have limited and/or incomplete information on

race/ethnicity (Kozak, 1995; Simonsen et al., 1998; Christensen et al., 2009). As a result, studies often focus on specific geographic areas or race/ethnicity groups to examine disparities (Becker et al., 1990; Doyle and Bryan, 2000; Holman et al., 2001; Holman et al., 2003; Holman et al., 2006; Arias et al., 2008; Singleton et al., 2009; Dahlgren, Moonesinghe and McQuiston, 2011; Medina-Marino et al., In Press). Several studies describe ID disparities among AI/AN people which include higher risk for certain IDs potentially due to factors such as increased poverty, overcrowded living conditions, lack of indoor plumbing, higher rates of some chronic diseases, and delayed access to care (Holman et al., 2001; Bulkow et al., 2002; Holman et al., 2003; Holman et al., 2006; Hennessy et al., 2008; Singleton et al., 2009; Holman et al., 2011). Differences in the social determinants of health of populations such as education, levels of poverty, race and ethnicity, and sex affect the impact of IDs on a population (Cohen, 2000; Wilkinson et al., 2003; Braveman et al., 2010; Braveman, Egerter and Mockenhaupt, 2011).

It is important to study the occurrence of IDs among race/ethnicity groups and examine potential patterns of disparities. Yet, recent studies describing the distribution of overall ID hospitalizations by racial and ethnic groups are few. The present study describes ID hospitalization rates in a racially and ethnically diverse state (Arizona) with nearly complete race/ethnicity data.

METHODS

The Arizona State Inpatient Database (SID) was obtained from Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality, for 2005-2008 (Healthcare Cost and Utilization Project (HCUP), October 2010). The Arizona SID included de-identified hospital discharge records from all inpatient stays in community hospitals; institutional review determined that this study did not involve human subjects and was not subject to Institutional Review Board review. An ID hospitalization was defined as a hospitalization with a primary (first-listed) diagnosis of an International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) code associated with an ID (National Center for Health Statistics; International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), 2011); ID hospitalizations were classified into overall and specific ID groups through ID definitions described in previous studies (Table 1) (Pinner et al., 1996; Simonsen et al., 1998). Birth hospitalizations were excluded from all analyses; the infant age group included non-birth hospitalizations for persons less than one year of age. The unit of analysis was a hospitalization.

Infectious disease hospitalization rates were calculated as the number of ID hospitalizations per 100,000 persons of the corresponding bridged-race census population for sex, race/ethnicity, and age group; rates were also calculated for specific ID groups. Race/ethnicity groups were defined by HCUP as white, black, Hispanic, Asian or Pacific Islander (A/PI), Native American, or other; patients with 'other' or missing race/ethnicity (3.7%) were excluded for analysis by race/ethnicity group. Age-specific rates by race/ethnicity were compared using Poisson regression analysis (Pedan; Kleinbaum et al., 1998).

Age-adjusted hospitalization rates were calculated using the direct method with the 2000 projected US population as the standard (Klein and Schoenborn, 2001). If the normal approximation was not appropriate age-adjusted rates were compared using gamma calculated 95% confidence intervals (Xu et al., 2010). The white race/ethnicity group was used as the referent category for comparisons by race/ethnicity. Unless specified otherwise or age-specific, all rates presented are age-adjusted rates.

To examine the most frequently listed discharge diagnoses, the first 9 diagnoses listed on ID hospitalization discharge records were examined (9 discharge diagnoses were available in 2005-2007 and 25 in 2008) (Healthcare Cost and Utilization Project (HCUP), August 2008). Median household income state quartile for patient zip code was used as a proxy for socioeconomic status to describe ID hospitalizations by race/ethnicity. Statistical significance was considered at $P < 0.05$.

Table 1: Infectious disease groups with *ICD-9-CM* codes.

Infectious disease group	<i>ICD-9-CM</i> code(s)
Tuberculosis	010-018, 137
Meningitis	027.0, 036, 320.0-321.3, 321.8
Septicemia	038, 499 ³ , 995.90-995.94
Human immunodeficiency virus infection and/or AIDS	042-044
Hepatobiliary disease	070, 095.3, 573.1, 573.2, 576.1
Mycoses	110-118
Infections of the heart	093, 391, 392.0, 393, 394.1, 395.0-395.2, 397.1, 397.9, 398, 421, 422.0, 424.9
Upper respiratory tract infection	032.0-032.3, 034.0, 098.6, 101, 460-465, 473.0-474.0, 475, 784.91 ²
Lower respiratory tract infection	022.1, 031.0, 033, 095.1, 466, 480-487, 510, 511.1, 513, 517.1, 770.0, 488 ³
Abdominal and rectal infection	095.2, 098.7, 540-542, 566, 567.0-567.2, 569.5, 567.38 ¹
Kidney, urinary tract, and bladder infection	095.4, 099.4, 590, 595.0, 597, 598.0, 599.0
Cellulitis	680-686
Enteric infection	001-009, 022.2
Viral central nervous system infection	045-049, 059.00 ⁴ , 059.09 ⁴ , 059.10-059.12 ⁴ , 059.19 ⁴
Infection due to internal prosthetic device, implant, and graft	996.6, 999.31 ³
Postoperative infection	998.5, 780.62 ⁴
Osteomyelitis, periostitis, and other infections involving bone	730
Inflammatory disease of female pelvic organs	614.0-614.5, 616.0-616.1, 616.3-616.4, 625.71 ⁴
Infection related to pregnancy, childbirth, or puerperium	634.0, 635.0, 636.0, 637.0, 638.0, 639.0, 646.5, 646.6, 647, 655.3, 658.4, 659.3, 670, 675

¹Code(s) added in October 2005

²Code(s) added in October 2006

³Code(s) added in October 2007

⁴Code(s) added in October 2008

RESULTS

Overall Infectious Disease Hospitalization Rates

During 2005-2008, there were 383,597 ID hospitalizations reported in Arizona for an age-adjusted rate of 1498.1 per 100,000 (Table 2). ID hospitalizations accounted for 15% of all hospitalizations. Overall, infants had the highest age-specific overall ID rate followed by persons ≥ 80 years of age (Table 3). Males and females had similar age-adjusted overall ID hospitalization rates (1502.5 per 100,000 and 1499.5, respectively). Persons of Native American and of black race/ethnicity had ID hospitalization rates higher than the rate for persons of white

race/ethnicity; persons of A/PI race/ethnicity had a much lower rate (Table 2). Among infants, those of Hispanic and Native American race/ethnicity had ID hospitalization rates higher than the rate for infants of white race/ethnicity (Figure 1 and Table 3). Among persons ≥ 80 years of age, the ID hospitalization rate for persons of Hispanic race/ethnicity was higher than the rate for persons of white race/ethnicity (Figure 1 and Table 3).

Overall, essential hypertension, unspecified was listed most often on an ID hospitalization record; pneumonia, organism unspecified was the second most listed diagnosis (Table 4). The most commonly listed diagnoses among the youngest age group (0-19 years of age) was pneumonia, organism unspecified; tobacco use disorder was most common among the middle age group (20-49 years); and essential hypertension, unspecified was most common among the oldest age group (≥ 50 years).

Rates of ID hospitalization were higher among groups with a large proportion of low-income population. The majority (62%) of ID hospitalizations among persons of Native American race/ethnicity were from ZIP codes in the lowest median household income state quartile. Forty-four percent of ID hospitalizations for persons of Hispanic race/ethnicity and 37% of persons of black race/ethnicity were among ZIP codes in the lowest median household income state quartile. Persons of white and A/PI race/ethnicity had 21% and 26%, respectively, of ID hospitalizations in the lowest income state quartile.

Infectious Disease Diagnostic Groups

The hospitalization rate for LRTI was the highest rate of all ID groups and accounted for 26% of ID hospitalizations (Table 2). Persons of black and Native American race/ethnicity had higher LRTI hospitalization rates than persons of white race/ethnicity, persons of Hispanic and A/PI race/ethnicity had lower rates. Infants had the highest LRTI hospitalization rate followed by persons ≥ 80 years of age (Table 3). Infants of Hispanic and Native American race/ethnicity had higher rates than infants of white race/ethnicity. Among persons ≥ 80 years of age, persons of Hispanic race/ethnicity had a higher LRTI rate than persons of white race/ethnicity, while persons of black race/ethnicity had a lower rate.

Cellulitis was the ID diagnostic group with the second highest overall hospitalization rate (Table 2); persons of Native American race/ethnicity had a rate higher than persons of white race/ethnicity. Persons of Hispanic and A/PI race/ethnicity had lower rates. The hospitalization rate for persons of A/PI race/ethnicity was 35% the rate for persons of white race/ethnicity. Persons ≥ 80 years of age had the highest cellulitis hospitalization rate; persons of black, Hispanic, and A/PI race/ethnicity had rates lower than persons of white race/ethnicity in this age group (Table 3).

Hospitalization rates for septicemia and for kidney, urinary tract, and bladder infection (KUTB) were higher for black, Hispanic and Native American race/ethnicity groups than the rate for white race/ethnicity; the rate for A/PI race/ethnicity was lower (Table 2). Persons of Native American race/ethnicity experienced a septicemia hospitalization rate two times the rate for persons of white race/ethnicity. Both the septicemia and KUTB hospitalization rates were highest among persons ≥ 80 years of age. Among septicemia hospitalizations in the ≥ 80 years age group, persons of black, Hispanic and Native American race/ethnicity had rates higher than persons of white race/ethnicity, while among KUTB hospitalizations persons of black and Hispanic race/ethnicity had higher rates than persons of white race/ethnicity (Table 3).

Table 2: Infectious Disease Age-Adjusted Hospitalization Rates by Infectious Disease group and Race/Ethnicity, Arizona, 2005-2008.*

	White	Black	Hispanic	Asian or Pacific Islander	Native American [†]	Overall
Infectious disease group	Rate	Rate	Rate	Rate	Rate	Rate
Overall infectious disease	1485.7	1807.8 [§]	1436.2 [§]	959.4 [§]	1815.7 [§]	1498.1
Lower respiratory tract infection	379.5	467.9 [§]	355.3 [§]	273.5 [§]	481.4 [§]	384.3
Cellulitis	214.0	206.9	162.1 [§]	75.0 [§]	264.4 [§]	200.3
Septicemia	146.6	207.6 [§]	170.1 [§]	116.4 [§]	294.6 [§]	156.9
Kidney, urinary tract, and bladder infection	137.4	172.5 [§]	173.9 [§]	91.9 [§]	157.1 [§]	145.6
Abdominal and rectal infection	143.2	86.8 [§]	139.2 [§]	104.4 [§]	83.5 [§]	140.6
Infection related to pregnancy, childbirth, or puerperium [‡]	69.9	92.1 [§]	109.9 [§]	46.5 [§]	60.9 [§]	86.5
Enteric infection	77.6	70.9 [§]	61.7 [§]	45.9 [§]	50.9 [§]	72.7
Infection due to internal prosthetic device, implant, and graft	68.4	133.2 [§]	69.7	31.0 [§]	138.5 [§]	71.7
Postoperative infection	56.3	49.7 [§]	39.2 [§]	22.5 [§]	54.8	52.4
Upper respiratory tract infection	37.5	45.3 [§]	34.2 [§]	22.9 [§]	33.3 [§]	36.5

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Mycoses	22.6	65.4 [§]	17.2 [§]	29.2 [§]	20.6	23.7
Osteomyelitis, periostitis, and other infections involving the bone	18.8	27.0 [§]	17.9	7.2 [§]	37.3 [§]	19.3
Inflammatory disease of female pelvic organs [‡]	16.7	26.1 [§]	15.7	7.0 [§]	19.6	16.7
Viral central nervous system infection	16.9	20.4	13.2 [§]	10.7 [§]	9.4 [§]	16.0
Infection of the heart	12.8	17.2 [§]	10.6 [§]	9.6	12.7	12.8
Human immunodeficiency virus infection and/or AIDS	10.1	51.1 [§]	10.7	4.5 [§]	9.5	11.9
Hepatobiliary disease	8.2	8.1	10.6 [§]	12.5 [§]	11.7 [§]	9.0
Meningitis	2.7	5.1 [§]	2.8	2.3	4.0	2.9
Tuberculosis	0.8	2.4 [§]	5.1 [§]	5.6 [§]	3.8 [§]	2.1

*Age-adjusted hospitalization rate, per 100,000 persons.

† Native American hospitalizations do not include hospitalizations at Indian Health Service facilities; this likely results in an underestimation of the true hospitalization rate.

‡ Female persons only.

§Statistically different ($P<0.05$) from the rate for White race/ethnicity.

Table 3: Infectious disease (ID) age-specific rates by ID group and race/ethnicity group for selected IDs, Arizona, 2005-2008.*

	<1 year	1-4 years	5-19 years	20-29 years	30-39 years	40-49 years	50-59 years	60-69 years	70-79 years	≥80 years
Infectious disease group										
Overall infectious disease	6470.9	1252.8	590.2	877.8	933.3	1226.5	1561.4	2233.1	3729.0	6281.0
White	5785.5	1296.4	605.4	931.0	1003.4	1237.0	1476.0	2121.8	3602.7	6197.0
Black	5328.1 [†]	1039.1 [†]	524.4 [†]	1080.1 [†]	1258.0 [†]	1868.8 [†]	2484.4 [†]	2999.0 [†]	4050.5 [†]	6265.7
Hispanic	6679.1 [†]	1110.6 [†]	563.6 [†]	773.0 [†]	728.6 [†]	983.2 [†]	1493.6	2394.4 [†]	4104.6 [†]	6426.1 [†]
A/PI	5014.2 [†]	1092.3 [†]	461.2 [†]	430.7 [†]	416.4 [†]	474.7 [†]	862.4 [†]	1356.4 [†]	2822.7 [†]	5267.1 [†]
Native American	7859.7 [†]	1676.9 [†]	478.8 [†]	773.6 [†]	1352.5 [†]	1843.4 [†]	2446.1 [†]	3096.1 [†]	4017.3 [†]	5559.4 [†]
Lower respiratory tract infection	3383.6	571.9	81.0	71.1	104.4	194.6	337.9	621.1	1248.1	2305.5
White	3049.1	558.2	85.8	81.8	120.1	201.5	325.5	602.2	1226.6	2266.9
Black	2704.6 [†]	449.6 [†]	109.4 [†]	118.2 [†]	183.1 [†]	425.4 [†]	663.0 [†]	890.4 [†]	1194.0	1921.1 [†]
Hispanic	3376.5 [†]	507.8 [†]	63.0 [†]	50.2 [†]	63.2 [†]	131.1 [†]	288.8 [†]	608.9	1263.6	2388.5 [†]
A/PI	2433.8 [†]	490.7	81.5	27.2 [†]	43.9 [†]	56.8 [†]	191.2 [†]	386.5 [†]	956.2 [†]	2109.0
Native American	5121.3 [†]	1029.4 [†]	93.1	71.7	159.8 [†]	273.7 [†]	471.8 [†]	738.8 [†]	1250.9	2328.3
Cellulitis	254.6	171.9	66.2	140.8	197.6	278.2	273.2	252.7	305.9	441.5
White	252.9	180.4	72.6	168.6	233.4	299.4	268.1	250.7	307.6	447.9
Black	259.6	200.0	70.5	148.2	209.2	317.9	342.9 [†]	209.4	226.7 [†]	299.9 [†]
Hispanic	233.2	144.4 [†]	54.9 [†]	98.9 [†]	132.7 [†]	196.7 [†]	252.0 [†]	242.8	300.2	363.6 [†]
A/PI	224.8	167.5	50.6 [†]	36.0 [†]	38.6 [†]	71.2 [†]	65.7 [†]	94.7 [†]	147.1 [†]	216.3 [†]
Native American	324.7 [†]	209.9	66.5	153.7	323.9 [†]	423.7 [†]	414.9 [†]	328.2 [†]	273.6	392.2
Septicemia	229.9	10.5	9.7	32.0	51.9	104.4	194.4	362.5	648.5	1101.1
White	258.9	11.3	10.6	32.5	46.8	92.8	174.5	328.5	603.8	1065.8

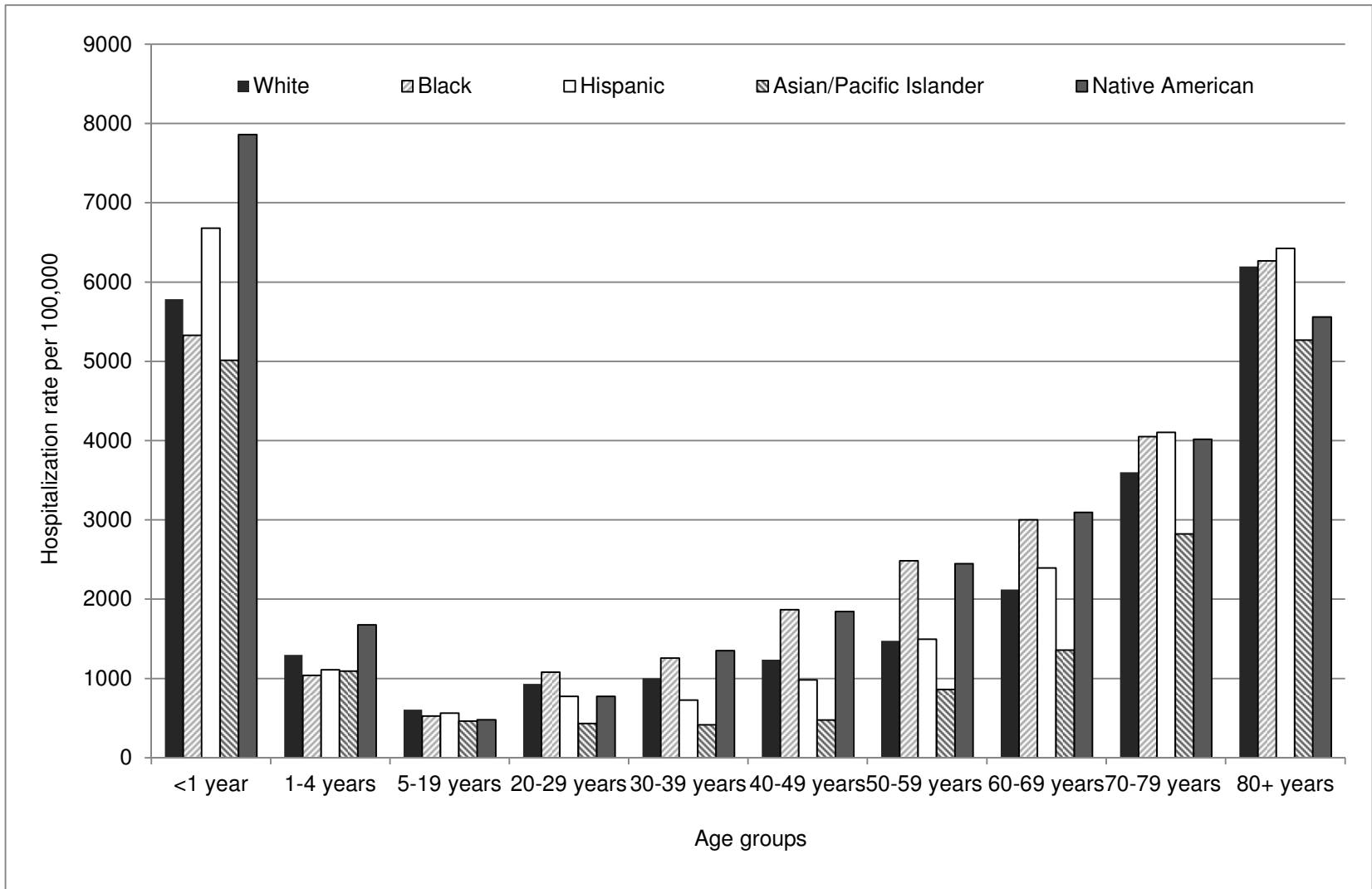
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Black	205.6	13.1	8.7	39.8	78.9 [†]	143.1 [†]	284.8 [†]	541.4 [†]	842.6 [†]	1264.5 [†]
Hispanic	178.5 [†]	8.5	7.3 [†]	26.1 [†]	39.8 [†]	97.8	195.9 [†]	427.3 [†]	785.6 [†]	1255.7 [†]
A/PI	117.3 [†]	-	10.3	23.3	22.7 [†]	47.5 [†]	109.4 [†]	239.4 [†]	570.1	1059.9
Native American	320.4	16.6	13.1	58.8 [†]	183.1 [†]	282.9 [†]	480.6 [†]	721.6 [†]	1001.3 [†]	1270.0 [†]
Kidney, urinary tract, and bladder infection	753.1	58.4	39.7	76.2	73.1	88.5	113.8	192.2	440.9	1079.9
White	526.9	59.9	43.8	83.0	75.7	80.5	97.8	170.3	409.2	1054.4
Black	562.6	26.1 [†]	31.5 [†]	96.0	78.9	115.3 [†]	137.8 [†]	289.7 [†]	547.9 [†]	1361.8 [†]
Hispanic	975.5 [†]	60.2	36.1 [†]	64.9 [†]	66.0 [†]	97.5 [†]	153.6 [†]	270.8 [†]	625.6 [†]	1261.2 [†]
A/PI	557.1	42.5	20.6 [†]	35.0 [†]	22.0 [†]	29.9 [†]	74.4	152.1	349.4	746.3 [†]
Native American	438.8	39.1 [†]	30.1 [†]	70.1	121.1 [†]	135.1 [†]	191.3 [†]	292.1 [†]	433.0	778.2 [†]

*Rate not displayed if rate calculated with ≤ 10 hospitalizations, A/PI stands for Asian or Pacific Islander.

[†] Statistically different ($P < 0.05$) from the rate for White race/ethnicity.

Figure 1: Infectious Disease Hospitalization Rates by Age Group and Race/Ethnicity, Arizona, 2005-2008.



Abdominal and rectal infection, enteric infection, postoperative infection, and viral central nervous system infection hospitalization rates for persons of white race/ethnicity were higher than or similar to the rates for all other race/ethnicity groups (Table 2). Persons of white race/ethnicity had similar or lower rates than other race/ethnicity groups for hepatobiliary disease, meningitis, and TB (Table 2). The meningitis hospitalization rate for persons of black race/ethnicity was almost twice the rate for persons of white race/ethnicity; TB hospitalization rates for all other race/ethnicity groups were at least three times the rate for persons of white race/ethnicity.

Persons of black and Native American race/ethnicity had hospitalization rates for infection due to internal prosthetic device, implant, and graft about two times the rate for persons of white race/ethnicity; persons of A/PI race/ethnicity had a rate less than half of the rate for persons of white race/ethnicity (Table 2). The mycoses hospitalization rate among persons of black race/ethnicity was almost three times the rate for persons of white race/ethnicity; persons of A/PI race/ethnicity also had a higher rate (Table 2). The mycoses rate for persons of Hispanic race/ethnicity was lower than the rate for persons of white race/ethnicity.

The rate for osteomyelitis, periostitis, and other infections involving the bone among persons of Native American race/ethnicity was almost twice the rate for persons of white race/ethnicity; the rate for persons of black race/ethnicity was also higher (Table 2). Persons of A/PI race/ethnicity had a rate less than half the rate for persons of white race/ethnicity for infections involving the bone. The hospitalization rate for HIV/AIDS for persons of black race/ethnicity was about five times the rate for persons of white race/ethnicity; the rate for persons of A/PI race/ethnicity was about half (Table 2).

Hospitalization rates for IDs related to pregnancy, childbirth, or puerperium were higher among persons of Hispanic race/ethnicity than persons of white race/ethnicity; the rate was also high among persons of black race/ethnicity. Hospitalization rates for another female-specific condition, inflammatory disease of the female pelvic organs, were higher among persons of black race/ethnicity than persons of white race/ethnicity.

Diagnoses listed on ID hospitalization records by race/ethnicity

Essential hypertension, unspecified, and pneumonia, organism unspecified were the first or second most common diagnoses on ID hospitalization discharge records for all race/ethnicity groups (Table 4). Urinary tract infection, site not specified, was the third most common diagnosis, except for Native Americans where diabetes mellitus without mention of complication was third most common.

Among all race/ethnicity groups, the most common diagnosis among children <20 years of age, was pneumonia, organism unspecified. The most common diagnosis among persons of white, Hispanic and A/PI race/ethnicity in the middle age group (20-49 years) was tobacco use disorder, while the most common among persons of black and Native American race/ethnicity was essential hypertension, unspecified. All race/ethnicity groups had essential hypertension, unspecified and pneumonia, organism unspecified as the most common diagnoses among persons ≥ 50 years of age.

Table 4: Top five diagnoses listed on infectious disease hospitalization records by race/ethnicity and age group, Arizona, 2005-2008.*

<i>ICD-9-CM</i> diagnosis (Code)	Overall, Rank (%)					
	Overall	White	Black	Hispanic	A/PI	Native American
Essential hypertension, unspecified (401.9)	1 (22.6)	1 (26.2)	1 (22.1)	2 (14.2)	2 (17.6)	2 (16.4)
Pneumonia, organism unspecified (486)	2 (21.1)	2 (22.8)	2 (20.6)	1 (16.3)	1 (20.5)	1 (21.0)
Urinary tract infection, site not specified (599.0)	3 (15.3)	3 (16.7)	3 (13.5)	3 (12.1)	3 (12.1)	4 (13.1)
Dehydration (276.51)	4 (10.7)	4 (11.6)	--	5 (8.7)	4 (11.6)	--
Diabetes mellitus without mention of complication (250.00)	5 (10.1)	--	5 (10.2)	4 (9.8)	5 (10.5)	3 (15.3)
Tobacco use disorder (305.1)	--	5 (10.4)	4 (11.5)	--	--	--
Hypertensive chronic kidney disease, unspecified (403.91)	--	--	--	--	--	5 (12.8)

<i>ICD-9-CM</i> diagnosis (Code)	0-19 years of age, Rank (%)					
	Overall	White	Black	Hispanic	A/PI	Native American
Pneumonia, organism unspecified (486)	1 (15.2)	1 (14.1)	1 (17.5)	1 (14.6)	1 (17.3)	1 (23.9)
Acute bronchiolitis due to respiratory syncytial virus (466.11)	2 (10.7)	4 (9.5)	2 (10.3)	2 (11.7)	3 (10.4)	2 (12.6)
Dehydration (276.51)	3 (10.4)	2 (12.1)	2 (10.3)	4 (8.8)	2 (12.2)	5 (9.4)
Acute appendicitis, without mention of peritonitis (540.9)	4 (9.1)	3 (10.2)	--	3 (9.2)	4 (9.5)	--
Acute bronchiolitis due to other infectious organisms (466.19)	5 (7.7)	--	--	5 (8.1)	5 (6.6)	4 (12.1)
Hypoxemia (799.02)	--	5 (7.3)	--	--	--	3 (12.3)
Asthma, unspecified (493.90)	--	--	3 (9.2)	--	--	--
Methicillin susceptible <i>Staphylococcus aureus</i> (041.11)	--	--	4 (6.9)	--	--	--

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<i>ICD-9-CM</i> diagnosis (Code)	20-49 years of age, Rank (%)					
	Overall	White	Black	Hispanic	A/PI	Native American
Tobacco use disorder (305.1)	1 (19.5)	1 (23.7)	2 (18.9)	1 (12.9)	1 (13.2)	--
Essential hypertension, unspecified (401.9)	2 (12.8)	2 (12.7)	1 (19.0)	4 (10.8)	5 (9.2)	1 (17.3)
Pneumonia, organism unspecified (486)	3 (11.1)	4 (11.4)	3 (16.1)	5 (9.2)	4 (10.3)	4 (12.5)
Hypopotassemia (276.8)	4 (10.9)	5 (10.3)	4 (12.4)	3 (11.8)	3 (11.8)	5 (12.2)
Methicillin susceptible <i>Staphylococcus aureus</i> (041.11)	5 (10.9)	3 (12.3)	--	--	--	--
Anemia, unspecified (285.9)	--	--	5 (10.4)	--	-	--
Acute appendicitis, without mention of peritonitis (540.9)	--	--	--	2 (12.2)	2 (12.8)	--
Diabetes mellitus without mention of complication (250.00)	--	--	--	--	--	2 (15.9)
Other cellulitis and abscess, leg, except foot (682.6)	--	--	--	--	--	3 (14.2)

<i>ICD-9-CM</i> diagnosis (Code)	≥50 years of age, Rank (%)					
	Overall	White	Black	Hispanic	A/PI	Native American
Essential hypertension, unspecified (401.9)	1 (36.4)	1 (36.9)	1 (37.4)	1 (35.9)	1 (35.2)	1 (27.1)
Pneumonia, organism unspecified (486)	2 (28.7)	2 (29.2)	2 (27.2)	2 (26.4)	2 (29.3)	2 (26.6)
Urinary tract infection, site not specified (599.0)	3 (22.7)	3 (22.9)	3 (22.2)	4 (23.0)	4 (20.0)	5 (21.7)
Diabetes mellitus without mention of complication (250.00)	4 (15.8)	--	4 (19.1)	3 (24.6)	3 (21.0)	3 (25.7)
Atrial fibrillation (427.31)	5 (14.2)	4 (16.0)	--	--	--	--
Congestive heart failure, unspecified (428.0)	--	5 (14.6)	--	--	--	--
Acute kidney failure, unspecified (584.9)	--	--	5 (14.5)	--	--	--
Hypertensive chronic kidney disease, unspecified (403.91)	--	--	--	5 (13.1)	--	4 (23.5)
Dehydration (276.51)	--	--	--	--	5 (13.2)	--

*A/PI stands for Asian or Pacific Islander

DISCUSSION

ID hospitalizations accounted for a considerable proportion of hospitalizations in Arizona. Similar to previous studies of ID hospitalizations in the United States, the highest ID hospitalization rates were among the youngest and oldest age groups (Holman et al., 2001; Curns et al., 2005; Christensen et al., 2009). Persons of Native American, black and Hispanic race/ethnicity experienced age-adjusted ID hospitalization rates that were higher than persons of white race/ethnicity for several important ID diagnoses. A study in the United States found persons of black race/ethnicity to have the highest ID hospitalization rate; however since 26% of hospitalizations were missing race/ethnicity data the study was unable to conduct detailed race/ethnicity analyses (Christensen et al., 2009). Due to nearly complete race/ethnicity data in the present study and the large population of Native Americans and Hispanics in Arizona (U.S. Census Bureau), comparisons between the rates for different race/ethnicity groups could be conducted.

The Arizona SID also allowed for description of the distribution of income by race/ethnicity group. A large proportion of ID hospitalizations among persons of Native American, black, and Hispanic race/ethnicity were from ZIP codes with the lowest median household income state quartile. Numerous studies have examined the link between ID rates and conditions of poverty (Doyle and Bryan, 2000; Hennessy et al., 2008; Bouye et al., 2009; Thompson et al., 2011). Poverty and other social determinants of health are known to be more prevalent among minority populations, disproportionately impacting the health status of these populations and resulting in measurable health disparities (Braveman and Barclay, 2009; King, Smith and Gracey, 2009).

The LRTI ID group had the highest hospitalization rate in Arizona, similar to that reported for previous national studies of ID hospitalizations (Simonsen et al., 1998; Christensen et al., 2009). The LRTI hospitalization rate was highest among the Native American and black race/ethnicity group; hospitalization rates for LRTI and for respiratory syncytial virus have been found to be higher among AI/AN children than for overall US children (Peck et al., 2005; Singleton et al., 2009; Singleton et al., 2011; Singleton et al., 2012).

Cellulitis was the ID group with the second highest hospitalization rate; an increase in nationwide cellulitis hospitalizations has been attributed to the emergence of methicillin-resistant *Staphylococcus aureus* (Frei et al., 2010; Lautz, Raval and Barsness, 2011). High rates of cellulitis in persons of Native American race/ethnicity have previously been documented and linked to low levels of in-home water service (Hennessy et al., 2008; Holman et al., 2011). Household crowding and poor hygiene, disproportionately represented among minority groups, are also known to be associated with higher burdens of infections of the skin (Bailie et al., 2005; Cairncross and Valdmanis, 2006; Badiaga, Raoult and Brouqui, 2008) and may also contribute to this finding. Persons of A/PI race/ethnicity had a rate of cellulitis that was 35% of the rate for persons of white race/ethnicity; due to limited race/ethnicity data on national hospitalization databases, we could not find where this relationship has been previously explored (Frei et al., 2010; Lautz, Raval and Barsness, 2011).

Diabetes, notably prevalent among minorities (Indian Health Service, 2007; Centers for Disease Control and Prevention, 2011c), is known to increase the risk for LRTIs, infections of the skin, urinary tract infections among adult women, and TB (Peleg et al., 2007). A diabetes diagnosis listed on an ID hospitalization was more frequent among racial and ethnic minorities than among white race/ethnicity; this was especially true among Native American ID

hospitalizations. Elevated rates of diabetes among racial minorities may in part explain the increased rates of certain infections among these groups.

The rate of septicemia hospitalizations was high among persons of Native American and black race/ethnicity; rates were also highest in the older age groups. A previous study of the elderly US population found higher rates of septicemia hospitalizations among persons of black race compared with persons of white race, however this study only examined these two race groups (McBean and Rajamani, 2001). Contrary to the findings in the present study, septicemia hospitalization rates among the AI/AN population have been found to be lower than the general U.S. population for all ages (Holman et al., 2011). An increase in the septicemia hospitalization rate (Simonsen et al., 1998; McBean and Rajamani, 2001) that may be due to an increased prevalence of chronic diseases (McBean and Rajamani, 2001) could potentially explain changes in racial/ethnic disparities of the disease. As seen in the present study, among persons of black and Native American race/ethnicity essential hypertension, unspecified is the first and second most commonly listed diagnosis, respectively, on an ID hospitalization record.

The high rates of pregnancy-related ID hospitalizations for persons of Hispanic and black race/ethnicity are congruent with nationally noted trends of limited or absent prenatal care among persons of Hispanic race/ethnicity (Doty; Moonesinghe et al., 2011). However, persons of Hispanic race/ethnicity are reported to have the highest pregnancy rate while persons of white race/ethnicity had the lowest rate (Arizona Department of Health Services, 2012); pregnancy rates may influence rates of pregnancy-related IDs and therefore, the observed differences in pregnancy-related ID hospitalization rates. Higher rates of inflammatory disease of the female pelvic organs among women of black race/ethnicity in Arizona similarly reflect trends that may be factors in persistent problems of preterm labor, low birthweight, and infant mortality (Behrman, Butler and Institute of Medicine (U.S.). Committee on Understanding Premature Birth and Assuring Healthy Outcomes., 2007; MacDorman et al., 2011; Martin, Centers for Disease and Prevention, 2011). Rates of hospitalization for HIV/AIDS among persons of black race/ethnicity were nearly five times higher than the rates for persons of white race/ethnicity, reflective of national HIV/AIDS disparities (Centers for Disease Control and Prevention, 2011b). Consistent with other studies (Cain et al., 2007; Cain et al., 2008), we observed the highest rates of TB among A/PI and Hispanic racial/ethnic groups which may reflect reactivation of latent TB infections among foreign-born persons arriving from high prevalence countries (Centers for Disease Control and Prevention, 2012).

Limitations

The current study has some limitations. ID hospitalizations were defined as hospitalizations with an ID as the first-listed diagnosis in an attempt to capture hospitalizations that were truly ID hospitalizations and present a conservative estimate. However, this method may include non-ID hospitalizations or exclude true ID hospitalizations because of miscoding or misclassification. Certain ID groups could be further analyzed taking into account differences within race/ethnicity groups; that is, procedure rates in each race/ethnicity group may affect postoperative infection rates. Also, rates of receiving internal prosthetic devices, implants or grafts may affect infection rates due to these procedures. The SID includes only inpatient stays in community nonfederal hospitals and would not include hospitalizations at federally-funded Indian Health Service (IHS) healthcare facilities. With numerous IHS/tribal inpatient facilities in operation in Arizona (Indian Health Service Areas), overall and specific ID group hospitalization rates for Native American race/ethnicity in this study are underestimated. Finally, these data could be subject to racial

misclassification, which is known to impact disease rates (Blustein, 1994; Thoroughman et al., 2002; Gomez and Glaser, 2006; Smith et al., 2010).

This study identified high rates of ID hospitalizations for specific diagnostic groups among persons of black, Native American and Hispanic race/ethnicity groups. These same racial/ethnic groups had high proportions of ID hospitalizations from ZIP codes in the lowest median household income state quartile. Focused ID prevention and control efforts are needed to address and reduce racial and ethnic disparities in ID hospitalizations.

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DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the funding agencies.

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