

Supplemental Appendix

Disparities in dental service use among adult populations in the U.S.

Yan Yan Wu ¹, Wei Zhang ², Bei Wu ^{3,*}

1. Office of Public Health Studies, University of Hawai‘i at Mānoa
1960 East-West Road, Honolulu, Hawai‘i 96822. Email: yywu@hawaii.edu
2. Department of Sociology, University of Hawai‘i at Mānoa
2424 Maile Way, Honolulu, Hawai‘i 96822. Email: weizhang@hawaii.edu
- 3.* Corresponding author, Rory Meyers College of Nursing, New York University
433 First Avenue, New York, New York, 10010. Phone: (212) 992-5951. Email: bei.wu@nyu.edu

Appendix Table 1. Sample size, proportion (%), and weighted proportion (wt%) by race/ethnicity and sample size by age group from 2002 to 2018 even years.

Year	White			Hispanic			Black			Asian			AIAN			NHOPI		
	N	%	wt%	N	%	wt%	N	%	wt%	N	%	wt%	N	%	wt%	N	%	wt%
2002	167426	80.2	72.2	15494	7.4	13.4	16166	7.7	9.7	4980	2.4	3.1	3238	1.6	1.2	1378	0.7	0.39
2004	209526	80.8	71.7	19904	7.7	14.6	22222	8.6	9.8	2881	1.1	2.5	4157	1.6	1.1	488	0.2	0.36
2006	243617	80.8	71.8	22487	7.5	14.5	24438	8.1	9.4	5339	1.8	2.7	4420	1.5	1.2	1192	0.4	0.44
2008	286846	81.5	70.4	24603	7.0	14.9	27622	7.8	10.0	6308	1.8	3.1	5057	1.4	1.1	1571	0.4	0.42
2010	309247	81.0	70.9	27406	7.2	14.0	30555	8.0	9.9	7439	1.9	3.7	5533	1.4	1.2	1507	0.4	0.38
2012	319659	79.5	66.4	30893	7.7	16.0	33896	8.4	11.6	8858	2.2	4.6	6200	1.5	1.1	2406	0.6	0.33
2014	315594	80.1	66.0	30702	7.8	16.2	29876	7.6	11.7	8733	2.2	4.8	6384	1.6	1.0	2605	0.7	0.31
2016	327145	79.0	65.0	33977	8.2	16.6	34115	8.2	11.8	9921	2.4	5.3	6603	1.6	1.0	2279	0.6	0.27
2018	288390	78.0	64.6	31946	8.6	17.0	30927	8.4	11.8	9084	2.5	5.3	6805	1.8	1.0	2486	0.7	0.26

Year	20-49			50-64			65+		
	N	%	wt%	N	%	wt%	N	%	wt%
2002	122529	59	64.7	50837	24	21.3	35316	17	14.0
2004	139420	54	63.3	71070	27	22.4	48688	19	14.3
2006	140434	47	61.3	93641	31	24.1	67418	22	14.6
2008	142426	41	59.9	117802	34	25.2	91779	26	14.9
2010	133565	35	58.1	132865	35	26.3	115257	30	15.6
2012	152661	38	56.2	132624	33	27.1	116627	29	16.7
2014	138569	35	55.0	131123	33	27.4	124202	32	17.6
2016	145588	35	54.7	131859	32	26.7	136593	33	18.6
2018	135846	37	53.9	111204	30	26.5	122588	33	19.6

Appendix Table 2. Crude and adjusted weighted prevalence of dental service utilization from 2002 to 2018 (even year) for younger (20-49), middle-aged (50-64) and older adults (65+), difference between adjusted prevalence and crude prevalence (diff: Adjusted - Crude), and average difference for each age group. Variables adjusted in the model: sex, education, income, employment status, health insurance, number of teeth removed and self-rated general health.

Crude (C) Adjusted (A)		White Prev (95CI) diff		Hispanic Prev (95CI) diff		Black Prev (95CI) diff		Asian Prev (95CI) diff		AIAN Prev (95CI) diff		NHOPI Prev (95CI) diff	
Age 20-49													
2002	C	73.6(73.1,74.1)		62.6(60.8,64.3)		65.5(64.0,67.0)		72.0(68.8,75.0)		65.0(60.8,69.0)		67.4(59.5,74.4)	
	A	72.8(72.2,73.3)	-0.8	72.0(70.3,73.6)	9.4	70.7(69.1,72.3)	5.2	66.9(63.1,70.5)	-5.2	72.7(68.4,76.5)	7.7	69.0(60.9,76.0)	1.6
2004	C	72.3(71.8,72.8)		61.3(59.6,62.9)		65.3(63.9,66.7)		68.6(64.8,72.1)		63.1(59.0,67.0)		69.4(60.1,77.4)	
	A	71.3(70.7,72.0)	-1.0	72.0(70.4,73.5)	10.7	70.8(69.3,72.2)	5.4	64.4(60.2,68.4)	-4.2	70.4(66.3,74.2)	7.3	69.6(59.7,78.0)	0.2
2006	C	71.1(70.5,71.7)		59.3(57.5,61.1)		62.8(61.2,64.4)		73.2(69.7,76.3)		62.8(57.9,67.3)		67.8(58.4,75.9)	
	A	69.4(68.7,70.1)	-1.7	71.4(69.6,73.1)	12.1	69.0(67.3,70.6)	6.2	66.7(62.6,70.6)	-6.5	71.2(66.6,75.4)	8.4	69.6(60.1,77.7)	1.8
2008	C	70.9(70.4,71.4)		61.2(59.6,62.7)		61.5(59.9,63.2)		72.7(69.7,75.6)		60.6(56.1,64.9)		66.8(59.2,73.6)	
	A	69.4(68.7,70.0)	-1.5	72.6(71.1,74.1)	11.4	67.8(66.0,69.4)	6.2	67.0(63.1,70.7)	-5.7	70.6(66.5,74.3)	10.0	70.6(62.6,77.6)	3.8
2010	C	71.1(70.6,71.6)		57.9(56.5,59.3)		61.7(60.3,63.2)		69.6(66.9,72.2)		57.4(53.0,61.8)		57.8(50.6,64.7)	
	A	68.9(68.2,69.5)	-2.2	69.5(68.1,71.0)	11.6	68.7(67.1,70.2)	7.0	61.9(58.7,65.0)	-7.7	67.7(63.1,72.0)	10.3	56.9(49.0,64.5)	-0.9
2012	C	67.4(66.9,67.9)		56.4(55.1,57.7)		58.9(57.5,60.3)		68.8(66.4,71.1)		58.0(54.4,61.6)		65.6(60.3,70.5)	
	A	67.4(66.8,68.0)	0.0	71.0(69.7,72.3)	14.6	67.9(66.5,69.4)	9.0	63.8(61.0,66.6)	-4.9	67.2(63.5,70.6)	9.1	69.7(64.0,74.9)	4.1
2014	C	66.6(66.1,67.1)		55.3(54.0,56.5)		57.7(56.3,59.1)		66.7(64.2,69.1)		55.2(51.8,58.5)		62.2(56.6,67.6)	
	A	67.0(66.3,67.6)	0.4	69.8(68.5,71.0)	14.5	66.7(65.2,68.1)	9.0	62.6(59.7,65.4)	-4.1	64.1(60.5,67.5)	8.9	66.8(61.4,71.7)	4.5
2016	C	67.6(67.0,68.1)		58.3(57.1,59.5)		61.2(59.9,62.5)		71.1(69.0,73.0)		55.6(52.4,58.9)		63.1(57.3,68.6)	
	A	67.3(66.7,68.0)	-0.2	70.7(69.5,71.9)	12.4	68.5(67.1,69.8)	7.3	65.8(63.4,68.2)	-5.2	63.9(60.5,67.2)	8.3	68.8(63.1,74.0)	5.7
2018	C	67.5(66.9,68.0)		59.5(58.2,60.8)		62.9(61.6,64.3)		70.3(68.1,72.5)		57.0(53.0,60.8)		63.5(59.0,67.7)	
	A	67.3(66.5,68.0)	-0.2	71.1(69.7,72.4)	11.6	69.4(68.0,70.8)	6.5	65.6(62.9,68.3)	-4.7	66.1(62.3,69.7)	9.1	68.9(64.1,73.2)	5.4
		Average diff	-0.8		12.0		6.9		-5.4		8.8		2.9
Age 50-64													
2002	C	79.7(79.1,80.3)		64.7(60.8,68.5)		63.2(60.2,66.1)		75.5(66.8,82.5)		71.8(65.4,77.5)		51.6(27.8,74.7)	
	A	79.0(78.3,79.7)	-0.7	75.3(71.8,78.5)	10.6	71.3(68.5,73.9)	8.1	70.1(59.8,78.6)	-5.4	78.0(72.2,82.8)	6.1	55.2(30.7,77.5)	3.6
2004	C	79.3(78.7,79.9)		63.2(59.8,66.4)		61.1(58.5,63.6)		81.5(74.4,87.0)		64.8(56.9,72.0)		81.9(65.6,91.5)	
	A	78.1(77.5,78.8)	-1.2	73.2(70.0,76.2)	10.0	68.9(66.2,71.5)	7.9	79.6(71.8,85.6)	-1.9	70.2(62.2,77.1)	5.4	78.3(60.1,89.6)	-3.6
2006	C	78.2(77.6,78.7)		60.8(57.5,64.1)		59.5(57.2,61.7)		82.2(77.5,86.2)		60.5(53.7,66.9)		72.8(54.3,85.8)	
	A	76.8(76.1,77.4)	-1.4	72.4(69.5,75.2)	11.6	68.0(65.7,70.2)	8.5	79.7(73.7,84.5)	-2.6	68.1(61.7,73.9)	7.7	72.9(53.7,86.2)	0.1

2008	C	78.8(78.4,79.3)		64.7(62.2,67.1)		61.2(59.2,63.2)		81.7(77.8,85.1)		66.0(61.0,70.7)		73.6(63.1,82.0)	
	A	77.6(77.1,78.1)	-1.2	76.1(73.9,78.2)	11.4	69.7(67.7,71.6)	8.5	80.1(75.5,84.0)	-1.7	73.6(68.9,77.8)	7.6	73.4(64.0,81.1)	-0.3
2010	C	77.0(76.5,77.4)		63.9(61.9,65.8)		61.4(59.8,63.0)		75.4(71.7,78.8)		63.9(59.4,68.2)		72.1(60.6,81.2)	
	A	75.8(75.3,76.2)	-1.2	75.8(74.0,77.4)	11.9	70.5(68.9,72.1)	9.1	72.6(68.6,76.2)	-2.8	73.8(69.1,78.0)	9.9	77.2(65.0,86.1)	5.1
2012	C	74.6(74.1,75.1)		60.1(57.9,62.2)		61.1(59.3,62.8)		81.6(77.6,85.0)		58.6(54.1,63.1)		69.4(60.5,77.1)	
	A	74.8(74.3,75.3)	0.2	74.4(72.4,76.3)	14.3	71.5(69.7,73.2)	10.4	80.3(75.4,84.4)	-1.3	69.4(65.4,73.1)	10.8	70.7(61.5,78.5)	1.3
2014	C	73.2(72.7,73.7)		59.4(57.3,61.5)		60.1(58.4,61.8)		78.1(74.1,81.6)		57.4(52.6,61.9)		63.6(54.9,71.6)	
	A	73.8(73.3,74.3)	0.6	73.5(71.6,75.3)	14.0	69.9(68.3,71.6)	9.8	77.5(72.5,81.8)	-0.6	69.0(64.3,73.3)	11.6	70.4(61.4,78.0)	6.7
2016	C	73.5(73.0,74.0)		62.1(60.1,64.1)		61.2(59.4,62.9)		79.2(75.4,82.6)		56.9(52.1,61.5)		76.9(69.5,83.0)	
	A	74.5(73.9,75.0)	1.0	75.2(73.4,76.9)	13.1	70.2(68.5,71.9)	9.0	78.2(73.7,82.1)	-1.0	67.0(61.6,72.0)	10.1	82.6(72.9,89.3)	5.7
2018	C	74.5(74.0,75.1)		61.1(58.7,63.5)		61.9(60.0,63.8)		75.7(71.1,79.8)		58.7(54.1,63.2)		71.2(62.9,78.3)	
	A	75.6(74.9,76.2)	1.0	73.8(71.5,76.1)	12.7	71.3(69.5,73.0)	9.3	74.3(68.9,79.0)	-1.4	70.5(66.5,74.2)	11.8	75.9(68.5,82.0)	4.7
		Average diff	-0.3		12.2		9.0		-2.1		9.0		2.6
Age 65+													
2002	C	79.8(79.1,80.6)		61.9(55.1,68.3)		56.3(51.6,60.8)		70.6(54.2,83.0)		65.7(52.1,77.2)		67.9(51.0,81.2)	
	A	80.1(78.9,81.1)	0.2	68.4(61.7,74.4)	6.5	62.9(58.5,67.1)	6.6	69.2(51.3,82.7)	-1.4	68.9(56.0,79.3)	3.1	67.0(53.6,78.1)	-0.9
2004	C	80.5(79.8,81.1)		64.4(59.3,69.1)		57.4(53.5,61.2)		75.1(57.9,86.8)		64.9(54.2,74.2)		63.1(12.6,95.3)	
	A	79.8(78.8,80.8)	-0.7	71.4(66.6,75.8)	7.0	63.0(58.8,67.0)	5.6	72.6(54.1,85.6)	-2.5	71.3(61.0,79.8)	6.5	63.8(28.6,88.6)	0.8
2006	C	80.0(79.5,80.6)		66.0(62.0,69.8)		55.0(51.6,58.4)		83.6(75.4,89.4)		63.5(53.2,72.8)		54.8(26.9,79.9)	
	A	79.7(78.9,80.6)	-0.3	74.0(70.0,77.6)	8.0	62.7(59.1,66.2)	7.7	82.2(73.7,88.4)	-1.4	69.3(58.0,78.7)	5.8	57.9(28.9,82.3)	3.1
2008	C	80.3(79.8,80.7)		67.5(64.4,70.5)		59.9(57.3,62.4)		80.2(74.3,84.9)		57.9(49.7,65.6)		73.6(57.0,85.4)	
	A	79.7(79.0,80.3)	-0.6	74.2(71.2,77.0)	6.7	65.9(63.2,68.5)	6.0	80.4(73.8,85.6)	0.2	63.9(55.7,71.5)	6.1	74.1(57.5,85.8)	0.5
2010	C	79.7(79.3,80.1)		63.3(60.6,65.8)		60.3(58.3,62.3)		78.5(73.8,82.5)		65.4(59.3,71.1)		72.9(61.4,81.9)	
	A	79.2(78.6,79.7)	-0.6	72.4(70.1,74.6)	9.1	67.0(64.7,69.1)	6.6	77.6(72.7,81.8)	-0.9	71.8(66.2,76.9)	6.4	75.8(64.5,84.4)	3.0
2012	C	77.9(77.4,78.3)		61.7(58.7,64.7)		55.0(52.4,57.6)		75.5(68.0,81.8)		58.0(51.4,64.3)		69.1(54.6,80.7)	
	A	77.4(76.7,78.1)	-0.5	71.1(68.2,73.9)	9.4	61.9(59.1,64.6)	6.9	74.9(67.3,81.3)	-0.6	64.1(56.7,70.8)	6.1	71.0(58.8,80.8)	1.9
2014	C	77.1(76.6,77.6)		61.9(59.1,64.7)		54.5(52.0,56.9)		80.0(74.6,84.5)		58.1(52.2,63.7)		38.7(25.3,54.0)	
	A	77.3(76.7,78.0)	0.2	73.5(70.9,76.0)	11.6	62.1(59.5,64.6)	7.6	77.1(70.5,82.5)	-2.9	66.1(60.4,71.4)	8.0	43.7(27.3,61.6)	5.0
2016	C	77.2(76.7,77.7)		61.0(58.2,63.6)		60.8(58.5,63.1)		77.6(71.7,82.6)		65.2(59.5,70.6)		60.3(46.7,72.5)	
	A	77.4(76.7,78.0)	0.2	71.0(68.4,73.4)	10.0	68.1(65.6,70.5)	7.3	78.3(72.0,83.4)	0.7	70.5(65.1,75.4)	5.3	64.0(51.0,75.2)	3.7
2018	C	77.7(77.2,78.3)		65.6(62.6,68.5)		58.6(55.9,61.3)		73.5(65.5,80.2)		60.5(54.7,66.0)		71.5(62.8,79.0)	
	A	78.1(77.3,78.8)	0.3	75.9(73.2,78.3)	10.2	66.2(63.4,68.8)	7.6	72.8(64.6,79.6)	-0.7	68.4(62.5,73.8)	7.9	75.2(65.9,82.6)	3.6
		Average diff	-0.2		8.7		6.9		-1.1		6.1		2.3

Appendix Table 3. Mean prevalence and rate of change per year of dental service utilization from 2012 to 2018 for Whites, Blacks, Hispanics, Asian, AIAN and NHOPI younger (20-49), middle-aged (50-64) and older adults (65+) estimated from the linear regression analysis of the adjusted wave-specific prevalences.

Race/ethnicity	Age group	Mean prevalence 2002-2018			Slope (change per year) between 2002-2018				
		Prev	95% CI		p	Slope	95% CI		p
White	65+	78.7	78.2	79.2	<0.001	-0.19	-0.28	-0.09	0.002
Asian	50-64	76.9	73.8	80.0	<0.001	0.07	-0.53	0.68	0.787
White	50-64	76.2	75.4	77.0	<0.001	-0.28	-0.43	-0.13	0.003
Asian	65+	76.1	72.7	79.5	<0.001	0.13	-0.53	0.80	0.654
Hispanic	50-64	74.4	73.4	75.5	<0.001	0.00	-0.20	0.21	0.968
NHOPI	50-64	73.0	67.4	78.5	<0.001	0.73	-0.34	1.80	0.150
Hispanic	65+	72.4	70.8	74.1	<0.001	0.21	-0.11	0.52	0.165
Hispanic	20-49	71.1	70.4	71.8	<0.001	-0.10	-0.24	0.03	0.120
AIAN	50-64	71.1	68.6	73.5	<0.001	-0.35	-0.82	0.12	0.120
Black	50-64	70.1	69.2	71.1	<0.001	0.08	-0.10	0.26	0.325
White	20-49	69.0	68.3	69.6	<0.001	-0.34	-0.46	-0.22	<0.001
Black	20-49	68.8	67.9	69.8	<0.001	-0.14	-0.32	0.04	0.117
AIAN	65+	68.3	65.8	70.7	<0.001	-0.09	-0.56	0.39	0.675
AIAN	20-49	68.2	67.1	69.3	<0.001	-0.53	-0.74	-0.31	<0.001
NHOPI	20-49	67.8	64.2	71.3	<0.001	-0.08	-0.76	0.60	0.792
NHOPI	65+	65.8	57.2	74.5	<0.001	0.01	-1.66	1.69	0.984
Asian	20-49	65.0	63.4	66.5	<0.001	-0.10	-0.40	0.20	0.449
Black	65+	64.4	62.6	66.2	<0.001	0.19	-0.15	0.54	0.225

Appendix Table 4. STROBE Checklist of cross-sectional studies.

	Item No	Recommendation	
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Indicated the cross-sectional study design in the abstract.
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Provided balanced information of study design, statistical methods and results
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Included in the Introduction sections
Objectives	3	State specific objectives, including any prespecified hypotheses	Included in the Introduction sections
Methods			
Study design	4	Present key elements of study design early in the paper	Method/data section
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Method/data section
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	Method/data source section
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Method/data source section
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Method/measures section
Bias	9	Describe any efforts to address potential sources of bias	Discussion section
Study size	10	Explain how the study size was arrived at	Method/Statistical analysis section
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Method/measures section
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Method/Statistical analysis section
		(b) Describe any methods used to examine subgroups and interactions	Method/Statistical analysis section
		(c) Explain how missing data were addressed	Method/Statistical analysis section
		(d) If applicable, describe analytical methods taking account of sampling strategy	Method/Statistical analysis section
		(e) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Figure 1.
		(b) Give reasons for non-participation at each stage	See measures
		(c) Consider use of a flow diagram	Figure 1

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results/sample characteristics
		(b) Indicate number of participants with missing data for each variable of interest	Results/sample characteristics
Outcome data	15*	Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Both provided in Figure and Tables
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	Done!
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Done!
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Done!
Generalisability	21	Discuss the generalisability (external validity) of the study results	Yes population based study, mentioned throughout the paper
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Included in the Acknowledgement