



HHS Public Access

Author manuscript

J Aging Health. Author manuscript; available in PMC 2022 August 01.

Published in final edited form as:

J Aging Health. 2021 ; 33(7-8 Suppl): 3S–9S. doi:10.1177/08982643211014399.

Aging and Health of American Indians and Alaska Natives: Contributions from the Native Investigator Development Program

Spero M. Manson, PhD¹, Dedra S. Buchwald, MD²

¹Centers for American Indian and Alaska Native Health, Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, USA

²Institute for Research and Education to Advance Community Health, Washington State University, Seattle, WA, USA

Abstract

Objectives: To describe recent advances in our knowledge regarding the health and illness of older American Indians and Alaska Natives, and factors underlying why this special population lives 5.5 years less than the 78.5 years of U.S. all races.

Methods: The articles in this supplemental issue, authored by participants in a National Institutes of Health-sponsored early research career development program, examine high priority health concerns that contribute to the increased risk of Native elders for chronic disease and resulting impairment that compromise their life expectancy.

Results: Important insights into the roles that racial discrimination, food security, hypertension, alcohol consumption, memory problems, and military service play in the health and well-being of older American Indians and Alaska Natives.

Discussion: Early career faculty development programs focused on increasing the diversity of the scientific workforce not only promote greater racial and ethnic minority representation in the field of aging, but can simultaneously add to the knowledge base regarding the health status and function of often ignored, vulnerable older members of communities that suffer significant health disparities.

Keywords

American Indian; Alaska Native; older adults; demographic and epidemiologic transitions; health risk; status; function

The life expectancy of an American Indian/Alaska Native has increased from 47.5 years of age in 1970 to 73.0 years of age today, a remarkable advance over just four decades (Dixon

Article reuse guidelines: sagepub.com/journals-permissions

Corresponding Author: Spero M. Manson, University of Colorado Denver-Anschutz Medical Campus, 13055 E. 17th Avenue, Mail Stop F800, Aurora, CO 80045, USA. spero.manson@cuanschutz.edu.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

& Roubideaux, 2001). Nonetheless, American Indians and Alaska Natives still live 5.5 years less than the United States all races figure of 78.5 years (Office of Minority Health, 2021b). Such progress is attributable primarily to highly effective public health measures that led to controlling infectious and communicable diseases and then the major causes of mortality in this special population (Dixon & Roubideaux, 2001). As a consequence of this shift in the attributable mortality of infectious diseases, major demographic and epidemiological transitions are underway in tribal communities (Young, 1996). Older adults now comprise a larger proportion of the Native population than ever before—a trend that is likely to continue. In 2016, 0.5% (258, 616) of American Indian and Alaska Native adults were at least 65 years of age; by 2060, this number is estimated to more than double, exceeding 0.7% (648,000) of this total population (National Indian Council on Aging, 2019). A corresponding shift in disease prevalence has occurred, moving from predominantly acute to chronic illnesses. Diabetes, cardiovascular disease, and Alzheimer’s disease and related dementias appear to have emerged as leading causes of morbidity and mortality and are an increasing part of the landscape of aging in Native America (Indian Health Service, 2019).

By virtually any measure, older American Indians and Alaska Natives are at greater risk than their non-Hispanic white counterparts for numerous acute and chronic illnesses. Diseases of the heart, cancer, unintentional injuries, and diabetes are four leading causes of mortality among the American Indian and Alaska Native population (National Center for Health Statistics, 2021). Furthermore, compared to all US citizens, members of this population die at higher rates from many other causes, including chronic liver disease and cirrhosis, intentional injuries (e.g., assault/homicide and self-harm/suicide), and chronic lower respiratory diseases (National Center for Health Statistics, 2021). Related complications and comorbidities contribute to more than half of the disabilities reported by older American Indian and Alaska Native adults. The consequences of these disabilities are exacerbated by limited access to high-quality specialty services, substantial delays in treatment, and deferred help-seeking behavior (Smith-Kaprosy et al., 2012; Young, 2021). This burden has led advocates to emphasize the premature aging of American Indians and Alaska Natives, which is reflected in the earlier attribution of elderhood in Native communities and in their lower age of eligibility for many federally sponsored services (Sokolovsky, n.d.).

The lower life expectancy of American Indians and Alaska Natives and their disproportionate disease burden are strongly related to a host of social determinants, including inadequate education, poverty, discrimination, cultural differences in perceptions of risk, limited access to care, and poorly resourced healthcare systems. Compared to their white peers, fewer American Indians and Alaska Natives aged 65 and over had finished high school (79% vs. 86%) or attained a bachelor’s degree or higher (30% vs. 21%) (Goins et al., 2015). Moreover, older American Indians and Alaska Natives more often live below the federal poverty line than all older Americans (18.8% vs. 9.3%). In sharp contrast to all other racial/ethnic groups, older American Indians are more likely to lack access to clean water and plumbing and to live in substandard and crowded housing (Levy et al., 2017).

American Indians and Alaska Natives face substantial barriers to accessing health care, a particularly noteworthy social determinant of health. Compared to their white counterparts, older Native people are more likely to have not seen a doctor in the past year due to cost

(19% vs. 13%) and to have delayed health care for other reasons (36% vs. 19%) (Artiga et al., 2013). The Indian Health Service (IHS) is the primary vehicle through which the federal government fulfills its trust responsibility to provide primary healthcare services to this special population. However, IHS has been chronically underfunded (United States Government Accountability Office, 2019). In 2018, 25% of healthcare provider positions nationally were vacant, and 30% vacant within the Navajo Nation, a conspicuous and shameful shortfall in the workforce given the impact of the COVID-19 pandemic on this tribe. Moreover, the IHS budget only provides \$4078 per capita for healthcare spending—less than half the amount spent for federal beneficiaries in the general population (Centers for Medicare and Medicaid Services, 2020; Indian Health Service, 2020). This meager per capita spending covers just 16% of the amount needed to fully fund all federally operated IHS, tribally operated, and urban Indian-operated facilities. IHS clinics are located predominantly on or near reservations in rural areas, making them inaccessible to urban American Indians and Alaska Natives, who represent more than 70% of the population (Urban Indian Health Institute, 2013). The 41 urban Indian health programs that were established to bridge this gap receive approximately 1% of the total IHS budget and have insufficient resources to meet the healthcare needs of their constituents (Indian Health Service, n.d.).

One of the overarching goals of *Healthy People 2000* was to chronicle the nature and extent of health disparities by comparing Health Status Indicators at national, state, and local levels. From 2000 to 2010, national trends for 17 Health Status Indicators improved for most US racial and ethnic groups (Keppel et al., 2002) but remained largely unchanged or, in some cases, even declined for American Indians and Alaska Natives. The National Center for Health Statistics, in its final report on *Healthy People 2010*, noted that health status disparities between American Indians and Alaska Natives and the total population were reduced for only 24 of 44 (55%) sub-objectives; disparities in 17 (39%) sub-objectives either did not change or widened (National Center for Health Statistics, 2001). Preliminary reports from *Healthy People 2020* suggest little subsequent progress in this regard.

Policy makers have only recently begun attempts to alter the individual-, family-, community-, and system-related determinants that contribute to these health disparities (Krieger et al., 2002; Marmot et al., 2008). Barriers to advancement in this arena have included, in part, the lack of relevant, immediately applicable research; a paucity of scientists working to close these gaps in our knowledge; and the resistance of Native communities to efforts that fail to incorporate their priorities and local systems of care. This supplemental issue of the *Journal of Aging and Health* represents an opportunity to summarize recent progress on all three fronts.

Many contributors to this issue participated in the Native Investigator Development Program, the centerpiece of the Native Elder Research Center, one of the Resource Centers for Minority Aging Research funded by the National Institute on Aging (Harawa et al., 2017; Manson et al., 2006). Supported continuously since 1997, we enjoy the privilege of directing this program, which, as evident in the articles that follow, has added substantially to our knowledge regarding aging and health among American Indians and Alaska Native adults. From its outset, the Native Investigator Development Program adopted

a distributed approach to promoting the research careers of early-stage American Indian and Alaska Native investigators. Recognizing the limitations of prior models that largely forced relocation to often distant institutions far from their homes and families, scholars remain at their respective institutions, and we contract for their time to participate to ensure their success. The program uses a hybrid strategy, blending highly structured didactic and experiential sessions cast within a framework of sequential milestones toward which all participants work in concert, albeit tailored to their substantive interests. This strategy is executed through multiple, intensive face-to-face and virtual meetings, supported by multidisciplinary mentoring teams that include content, methods, and statistical experts. Participants work toward submitting scientifically meritorious manuscripts to a peer-reviewed journal and NIH research grant applications consistent with their interests. Over the course of its 23-year existence, the 52 graduates produced more than 500 peer-reviewed journal articles and acquired in excess of \$200 million in sponsored research, and 22 have been awarded tenure at their respective universities. Moreover, the Native Investigator Development Program has markedly diversified the scientific workforce: most of the scholars are themselves American Indian or Alaska Native and are well represented among today's emerging leadership in Indian health research, policy, and advocacy. The articles contained herein stem from participation in this program. Below, we locate their contributions to the relevant literature on aging and health in this special population.

Experiences of discrimination are frequent among older adults in general and amplify their vulnerability to poor health (Marquet et al., 2019). For example, one study observed that 63% and 31% of older adults reported everyday discrimination and major discriminatory events, respectively (Luo et al., 2011). Age-related discrimination was the most commonly self-reported form of discrimination. After controlling for general stress, everyday discrimination adversely affected emotional health, such as increased reports of depressive symptoms and lower self-reported general health. Although older adults perceive lower levels of racial discrimination than their younger counterparts, they are still likely to associate experiences of such discrimination with their health status, function, and access to care (Ayalon & Gum, 2011). Two articles in this special issue move us into this arena and are the first to deal pointedly with discrimination, health, and aging among older American Indians and Alaska Natives.

Danyluck and his colleagues studied the effects of perceived racism on cardiovascular risk among 303 community-based urban-dwelling American Indian and Alaska Native adults aged 18 to 78. Participants completed a 3-hour study visit that comprised laboratory tests followed by monitoring cardiovascular function and self-reported emotional and psychological stress. Their article examines age differences in the association between lifetime and past-week experiences of racial discrimination and depressive symptoms among study participants. Depressive symptoms were regressed on racial discrimination, age, and their interaction, adjusting for demographic factors and other life stressors. Lifetime and past-week discrimination were significantly associated with depressive symptoms; these associations were stronger among younger than older American Indians and Alaska Natives. The results are consistent with prior reports in other populations, highlighting the importance of considering such questions within a life course perspective of Native aging. Their conclusions are limited by the cross-sectional nature of the data, which lead them to

recommend longitudinal and qualitative work to understand why racial discrimination may have less effect on the mental health for older adults than that of younger Native people.

Gonzales and her coauthors examined the association of perceived racial discrimination with participant retention and diabetes risk using data derived from 2553 American Indian and Alaska Native adults (16% aged 60 and older). This population has the highest prevalence of type 2 diabetes among all US racial and ethnic groups (Jiang et al., 2013), along with its associated comorbidities, including hypertension, cerebrovascular disease, renal failure, lower-extremity amputations, and depression (Bullock et al., 2020). The data for Gonzales et al.'s article comes from the Special Diabetes Program for Indians Diabetes Prevention Demonstration Project, the first large-scale, multisite, longitudinal lifestyle intervention to prevent diabetes conducted in this population. Older participants reported less perceived racial discrimination than their younger counterparts. In an unadjusted analysis, across all ages, racial discrimination was significantly and negatively associated with short-term and long-term retention and diabetes risk. After controlling for socioeconomic characteristics and clinical outcomes, perceived discrimination was no longer associated with retention but was significantly related in general to less improvement in body mass index and high-density lipoprotein cholesterol over the first 12 months of participating in the intervention. The authors call for further inquiry into the effects of perceived discrimination on the health of Native elders with respect to the prevention and management of diabetes and other chronic diseases.

The article by Stotz and her team continues the focus on diabetes but through the lens of food security and its implications for healthy eating among American Indian and Alaska Native adults with type 2 diabetes, especially elders who are at added risk of poor diet and nutrition. The U.S. Department of Agriculture defines food insecurity as the lack of consistent access to enough food for an active, healthy life (Coleman-Jensen et al., 2019). Native people disproportionately experience both poverty and food insecurity (Bauer et al., 2012; Gundersen, 2008; Jernigan et al., 2017), the latter at twice the rate as non-Hispanic whites (Jernigan et al., 2017). Healthy eating is central to diabetes self-management and glycemic control (Seligman et al., 2012). People with diabetes who experience challenges accessing healthy food have worse glycemic control and diabetes outcomes than do those with reliable access to such foods (Lyles et al., 2013; Mayer et al., 2016). Stotz and colleagues conducted focus groups and interviews with purposively selected stakeholders representing Native elders with diabetes, their family members, healthcare administrators, nutrition and diabetes educators, and national content experts on Indian health. Emerging themes included the recognition that rural- and urban-dwelling American Indians and Alaska Natives experience different forms of food security and associated challenges such as loss of traditional foods, meal preparation, and well-balanced nutrition. They also observed that factors beyond the cost of healthy food contribute to food insecurity, including lack of access to fresh fruits and vegetables and loss of traditional foods, which speaks to dietary preference. Last, the authors noted other barriers to consuming fresh, healthy food such as preparation time, limited cooking knowledge, and challenges of personal gardening. The article closes by arguing for a more creative, expansive view of future nutrition education resources and interventions for American Indians and Alaska Natives who experience food

insecurity and challenges to healthy eating, with the goal of improving their diabetes outcomes.

Diabetes and hypertension often go hand in hand with serious health consequences for American Indian and Alaska Native people, such as cardiovascular disease and stroke (Breathett et al., 2020; Office of Minority Health, 2021a). Hypertension prevalence is estimated at upward of 40% among Native adults, compared to 32% among whites (Jolly et al., 2015). Controlling blood pressure is paramount to preventing hypertension-related morbidity and mortality, but successful control depends on sustained patient engagement with a clinical care team. Engagement and medication adherence can be serious challenges among older adults, especially those with limited access to services and understanding of treatment processes (Manson et al., 2011). The article by Schaefer and her colleagues assessed the performance of two automated devices for home blood pressure monitoring among 100 patients in a large Alaska Native primary care system. Importantly, the study gathered information on their preferred device, which would likely influence use and adherence to treatment. Participants completed three visits evenly spaced over 2 weeks in a longitudinal crossover study. At each visit, systolic and diastolic blood pressure were measured using three devices: a calibrated aneroid sphygmomanometer as the gold standard, an automated upper arm cuff blood pressure monitor, and an automated wrist cuff blood pressure monitor. Device order was randomized, and multiple measures were taken at each administration. The upper arm device proved to be more accurate, though patients preferred the convenience of a wrist cuff. Schaefer et al., therefore, argues for a more patient-oriented, empirically based approach to assessing the relative merits of different technologies for measuring and managing blood pressure. These findings illustrate the interplay of clinical accuracy and patient preferences in selecting devices used to manage chronic conditions in the home setting.

American Indians and Alaska Natives generally consume alcohol in similar or lower quantities compared to the majority US population, although use varies by tribe, age, and sex (Beals et al., 2003; Whitesell et al., 2012). This is especially true among Native elders who drink substantially less alcohol than older adults in general (Greene et al., 2014). However, the prevalence of binge drinking is higher among American Indians and Alaska Natives than their non-Native counterparts, with the most extreme differences observed among adults aged 26 to 49 (Kanny et al., 2012). Binge drinking, defined as the consumption of at least 5 standard alcohol units within a two-hour period, has been linked to increased risk of cerebrovascular disease, especially in late life (Suchy-Dicey et al., 2017). Older Native people experience disparities in cerebrovascular disease-related comorbidities such as a high prevalence of hypertension, diabetes, obesity, vascular brain injury, and cerebral atrophy. Cerebral atrophy, detected as ventricular enlargement or sulcal widening on MRI, is recognized as a risk factor for vascular dementia or Alzheimer's disease. A major question arises, then, as to the contribution of binge drinking or heavy alcohol use to vascular brain injury in this population. Lewis and his coauthors examined the association of self-reported binge drinking with vascular brain injury, measured by magnetic resonance imaging (MRI), among 817 older participants in the groundbreaking Strong Heart and Cerebrovascular Disease and Its Consequences in American Indians study (Suchy-Dicey et al., 2016). Binge drinking was measured four times over a 25-year time period spanning

participants' middle life and late life. Any binge drinking at these multiple time points was associated with increased sulcal and ventricle dilatation compared to the no binge drinking condition. These associations are consistent with previous findings in other populations but the first documented for older American Indians. The results strongly suggest that binge drinking may contribute to vascular brain injury in Native elders, highlighting modifiable health behaviors for cerebrovascular disease risk reduction and disease prevention.

The article by Adamsen and her team moves to the other end of the spectrum of brain health among older American Indians and Alaska Natives and examines the association of cultural participation and social engagement with self-reported diagnosis of memory problems. Drawing upon the *Identifying Our Needs: A Survey of Elders*, conducted every 3 years by the National Resource Center on Native American Aging, the authors analyzed cross-sectional data on 14,827 Native elders aged 55 years and older collected by the 2014–2017 survey. Compared to participants who endorsed high cultural participation and/or high social engagement, those reporting low cultural participation and/or low social engagement had significantly higher odds of self-reported memory problems, suggesting a strong association that warrants further study for potential causality. As suggested by the general literature on value of social engagement in Alzheimer's disease (Daykin et al., 2017; Krueger et al., 2009), cultural participation, social engagement, and memory loss are strongly related, albeit the direction of these relationships remains uncertain. Nonetheless, Adamsen and colleagues suggest these observations support the growing call to maximize Native elders' participation in cultural practices and the social life of their communities.

American Indians and Alaska Natives are overrepresented among the nearly 12 million US military veterans at least 55 years of age or older. Indeed, since 9/11, nearly 19% of all Native men and women have served in the armed forces, compared to 14% of all other racial and ethnic groups (U.S. Department of Veterans Affairs, 2012). Native male veterans carry a higher burden of disease (Koo et al., 2015), are more likely to delay care due to difficulty in accessing services, and have lower socioeconomic status than their white counterparts (U.S. Department of Veterans Affairs, 2017). Moreover, 37% of American Indian and Alaska Native veterans have a service-related or other disability, compared to 29% of all other veterans (U.S. Department of Veterans Affairs, 2017). Much of our knowledge of Native veteran health has focused on mental health problems and culturally competent care (Kaufman et al., 2020; Noe et al., 2014), with very little research on their physical health and function compared to other groups. In their article, Huyser and her coauthors begin to fill this gap by examining the self-rated health and functional disability of American Indian and Alaska Native veterans compared to white veterans. The authors used data from the 2010 National Survey of Veterans (U.S. Department of Veterans Affairs, 2010), a large, nationally representative sample that contains detailed information about respondent military service, socioeconomic attainment, and self-reported health. Multivariate analyses compared self-rated health and activities of daily living by basic demographics and controlled for otherwise confounding socioeconomic variables among 7596 veterans who reported their race as non-Hispanic white, American Indian, or Alaska Native. American Indian and Alaska Native veterans were younger, had lower incomes, and higher levels of exposure to combat and environmental hazards compared to white veterans. In adjusted analyses, American Indian and Alaska Native veterans also significantly more often reported fair/poor

health limitation of one or more activities of daily living. These results document that American Indian and Alaska Native veterans are greatly disadvantaged with respect to their white counterparts in terms of health status and disability. Huyser and her colleagues, therefore, encourage greater attention to the physical and mental health consequences of military service, the adequacy of and access to relevant services, and the coordination of care across tribal, IHS, and Veterans Administration delivery systems.

One element of the Native Investigator Development Program not readily evident in these articles is many of the authors' careful consideration of the major healthcare priorities at issue in Native communities today. The topics are not random, nor do the articles convey the lengths to which key stakeholders were often included in shaping the questions asked, tailoring research designs to address these questions, acquiring relevant data, and interpreting the findings in ways that serve both good science and locally meaningful benefit. This is not surprising as the conventional format for reporting scientific work typically does not emphasize these aspects of the research enterprise, except perhaps as assurances of appropriate institutional review board approval. Indeed, the inclusion of Native voices is fundamental, though often not evident, to the agenda of most researchers at work in this field. Other participants in our program have written more explicitly about these less apparent processes (Goins et al., 2011; Manson et al., 2004), which underpin the efforts yielding the research presented in this special issue.

The value of these contributions clearly resides in the knowledge discovered about aging and health among American Indians and Alaska Natives. This issue is also as much about the young investigators—Native and non-Native alike—who generated this knowledge in partnership with the people whose lived experience is the subject of their inquiry. The demands of community-based participatory research add layers of effort, time, and complexity to pursuing answers, in this case, to questions at the intersection of aging, health, and older Native people. However, the intrinsic reward for these nascent scholars is to engage constituents whose families and communities echo their own experiences and to contribute to advancing the health and well-being of their elders, the keepers of wisdom and tradition central to life in Native America.

Acknowledgments

The authors specially thank Ms Sara Mumby, Publications Manager and Media Coordinator, Centers for American Indian and Alaska Native Health, for her extraordinary effort in shepherding this special issue from beginning to end.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The preparation of this manuscript is supported in part by the National Institute on Aging [P30AG015292 (Manson), P30AG059295 (Buchwald, Manson, Galvin), P30 AG066509 (Grabowski)], the National Institute on Minority Health and Health Disparities [U54MD000507 (Manson, Buchwald), U54MD011240 (Buchwald, Manson)], the National Institute on Diabetes and Digestive and Kidney Diseases [P30DK092923 (Manson)], and the National Institute on Alcohol Abuse and Alcoholism [P60AA026112 (Buchwald)].

References

- Artiga S, Arguello R, & Duckett P (2013). Health coverage and care for American Indians and Alaska Natives. <https://www.kff.org/racial-equity-and-health-policy/issue-brief/health-coverage-and-care-for-american-indians-and-alaska-natives/>
- Ayalon L, & Gum AM (2011). The relationships between major lifetime discrimination, everyday discrimination, and mental health in three racial and ethnic groups of older adults. *Aging & Mental Health*, 15(5), 587–594. doi:10.1080/13607863.2010.543664 [PubMed: 21815851]
- Bauer KW, Widome R, Himes JH, Smyth M, Rock BH, Hannan PJ, & Story M (2012). High food insecurity and its correlates among families living on a rural American Indian reservation. *American Journal of Public Health*, 102(7), 1346–1352. doi:10.2105/ajph.2011.300522 [PubMed: 22594740]
- Beals J, Spicer P, Mitchell CM, Novins DK, & Manson SM, & AI-SUPERPPF Team. (2003). Racial disparities in alcohol use: Comparison of 2 American Indian reservation populations with national data. *American Journal of Public Health*, 93(10), 1683–1685. doi:10.2105/ajph.93.10.1683 [PubMed: 14534221]
- Breathett K, Sims M, Gross M, Jackson EA, Jones EJ, Navas-Acien A, Taylor H, Thomas KL, & Howard BV (2020). Cardiovascular health in American Indians and Alaska Natives: A scientific statement from the American Heart Association. *Circulation*, 141(25), e948–e959. doi:10.1161/CIR.0000000000000773 [PubMed: 32460555]
- Bullock A, Sheff K, Hora I, Burrows NR, Benoit SR, Saydah SH, Hardin CL, & Gregg EW (2020). Prevalence of diagnosed diabetes in American Indian and Alaska Native adults, 2006–2017. *BMJ Open Diabetes Research & Care*, 8(1), Article e001218. doi:10.1136/bmjdr-2020-001218
- Centers for Medicare and Medicaid Services. (2020). National health expenditure data: Historical. U.S. Department of Health and Human Services. <https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nationalhealthaccountshistorical>
- Coleman-Jensen A, Rabbitt MP, Gregory C, & Singh A (2019). Household food security in the United States in 2018 (No. ERR-270). <https://www.ers.usda.gov/publications/pub-details/?pubid=94848>
- Daykin N, Mansfield L, Meads C, Julier G, Tomlinson A, Payne A, Grigsby Duffy L, Lane J, D’Innocenzo G, Burnett A, Kay T, Dolan P, Testoni S, & Victor C (2017). What works for wellbeing? A systematic review of wellbeing outcomes for music and singing in adults. *Perspectives in Public Health*, 138(1), 39–46. doi:10.1177/1757913917740391 [PubMed: 29130840]
- Dixon M, & Roubideaux Y (Eds) (2001). Promises to keep: Public health policy for American Indians and Alaska Natives in the 21st century. American Public Health Association.
- Goins RT, Garrouette EM, Fox SL, Dee Geiger S, & Manson SM (2011). Theory and practice in participatory research: Lessons from the native elder care study. *The Gerontologist*, 51(3), 285–294. doi:10.1093/geront/gnq130 [PubMed: 21292753]
- Goins RT, Schure MB, Crowder J, Baldrige D, Benson W, & Aldrich N (2015). Lifelong disparities among older American Indians and Alaska Natives. (Research Report 2015–08). <https://www.aarp.org/ppi/info-2015/lifelong-disparities-among-older-american-indians-and-alaska-natives.html>
- Greene KM, Eitle TM, & Eitle D (2014). Adult social roles and alcohol use among American Indians. *Addictive Behaviors*, 39(9), 1357–1360. doi:10.1016/j.addbeh.2014.04.024 [PubMed: 24857795]
- Gundersen C (2008). Measuring the extent, depth, and severity of food insecurity: An application to American Indians in the USA. *Journal of Population Economics*, 21(1), 191–215. doi:10.1007/s00148-007-0152-9
- Harawa NT, Manson SM, Mangione CM, Penner LA, Norris KC, DeCarli C, Scarinci IC, Zissimopoulos J, Buchwald DS, Hinton L, & Pérez-Stable EJ (2017). Strategies for enhancing research in aging health disparities by mentoring diverse investigators. *Journal of Clinical and Translational Science*, 1(3), 167–175. doi:10.1017/cts.2016.23 [PubMed: 28856013]
- Indian Health Service. (2019). Disparities [fact sheet]. <https://www.ihs.gov/newsroom/factsheets/disparities/>
- Indian Health Service. (2020). IHS profile: Based on 2015–2020 data. <https://www.ihs.gov/newsroom/factsheets/ihsprofile/>
- Indian Health Service. (n.d.). Office of Urban Indian Health Programs. <https://www.ihs.gov/urban/>

- Jernigan VBB, Huyser KR, Valdes J, & Simonds VW (2017). Food insecurity among American Indians and Alaska Natives: A national profile using the current population survey-food security supplement. *Journal of Hunger & Environmental Nutrition*, 12(1), 1–10. doi:10.1080/19320248.2016.1227750 [PubMed: 28491205]
- Jiang L, Manson SM, Beals J, Henderson WG, Huang H, Acton KJ, & Roubideaux Y (2013). Translating the diabetes prevention program into American Indian and Alaska native communities: Results from the special diabetes program for Indians diabetes prevention demonstration project. *Diabetes Care*, 36(7), 2027. doi:10.2337/dc12-1250 [PubMed: 23275375]
- Jolly SE, Koller KR, Metzger JS, Day GM, Silverman A, Hopkins SE, Austin MA, Boden-Albala B, Ebbesson SOE, Boyer BB, Howard BV, & Umans JG (2015). Prevalence of hypertension and associated risk factors in Western Alaska Native people: The Western Alaska Tribal Collaborative for Health (WATCH) Study. *The Journal of Clinical Hypertension*, 17(10), 812–818. doi:10.1111/jch.12483 [PubMed: 25644577]
- Kanny D, Liu Y, & Brewer RD (2012). Vital Signs: Binge drinking prevalence, frequency, and intensity among adults — United States, 2010. *Morbidity and Mortality Weekly Report*, 61(1), 14–19. <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6101a4.htm>. [PubMed: 22237031]
- Kaufman CE, Asdigian NL, Running Bear U, Beals J, Manson SM, Dailey N, Bair B, & Shore JH (2020). Rural and urban American Indian and Alaska Native veteran health disparities: A population-based study. *Journal of Racial and Ethnic Health Disparities*, 7(6), 1071–1078. doi:10.1007/s40615-020-00730-w [PubMed: 32189220]
- Keppel KG, Percy JN, & Wagener DK (2002). Trends in racial and ethnic-specific rates for the health status indicators: United States, 1990–98. *Healthy People 2000 Statistical Notes*(23), 1–16. [PubMed: 11808619]
- Koo KH, Hebenstreit CL, Madden E, Seal KH, & Maguen S (2015). Race/ethnicity and gender differences in mental health diagnoses among Iraq and Afghanistan veterans. *Psychiatry Research*, 229(3), 724–731. doi:10.1016/j.psychres.2015.08.013 [PubMed: 26282226]
- Krieger J, Allen C, Cheadle A, Ciske S, Schier JK, Senturia K, & Sullivan M (2002). Using community-based participatory research to address social determinants of health: Lessons learned from Seattle partners for healthy communities. *Health Education & Behavior*, 29(3), 361–382. doi:10.1177/109019810202900307 [PubMed: 12038744]
- Krueger KR, Wilson RS, Kamenetsky JM, Barnes LL, Bienias JL, & Bennett DA (2009). Social engagement and cognitive function in old age. *Experimental Aging Research*, 35(1), 45–60. doi:10.1080/03610730802545028 [PubMed: 19173101]
- Levy DK, Biess J, Baum A, Pindus N, & Murray B (2017). Housing needs of American Indians and Alaska Natives living in urban areas: A report from the assessment of American Indian, Alaska native, and native Hawaiian housing needs. <https://www.huduser.gov/portal/sites/default/files/pdf/NAHSG-UrbanStudy.pdf>
- Luo Y, Xu J, Granberg E, & Wentworth WM (2011). A longitudinal study of social status, perceived discrimination, and physical and emotional health among older adults. *Research on Aging*, 34(3), 275–301. doi:10.1177/0164027511426151
- Lyles CR, Wolf MS, Schillinger D, Davis TC, DeWalt D, Dahlke AR, Curtis L, & Seligman HK (2013). Food insecurity in relation to changes in hemoglobin A1c, self-efficacy, and fruit/vegetable intake during a diabetes educational intervention. *Diabetes Care*, 36(6), 1448–1453. doi:10.2337/dc12-1961 [PubMed: 23275354]
- Manson SM, Garrouette E, Goins RT, & Henderson PN (2004). Access, relevance, and control in the research process. *Journal of Aging and Health*, 16(Suppl 5), 58S–77S. doi:10.1177/0898264304268149 [PubMed: 15448287]
- Manson SM, Goins RT, & Buchwald DS (2006). The Native investigator development program: Increasing the presence of American Indian and Alaska Native scientists in aging-related research. *Journal of Applied Gerontology*, 25(Suppl 1), 105S–130S. doi:10.1177/0733464805282727
- Manson SM, Jiang L, Zhang L, Beals J, Acton KJ, & Roubideaux Y, & The SDPI Healthy Heart Demonstration Project (2011). Special diabetes program for Indians: Retention in cardiovascular risk reduction. *The Gerontologist*, 51(suppl_1), S21–S32. doi:10.1093/geront/gnq083. [PubMed: 21565816]

- Marmot M, Friel S, Bell R, Houweling TA, & Taylor S (2008). Closing the gap in a generation: Health equity through action on the social determinants of health. *The Lancet*, 372(9650), 1661–1669. doi:10.1016/s0140-6736(08)61690-6
- Marquet M, Chasteen AL, Plaks JE, & Balasubramaniam L (2019). Understanding the mechanisms underlying the effects of negative age stereotypes and perceived age discrimination on older adults' well-being. *Aging & Mental Health*, 23(12), 1666–1673. doi:10.1080/13607863.2018.1514487 [PubMed: 30457350]
- Mayer VL, McDonough K, Seligman H, Mitra N, & Long JA (2016). Food insecurity, coping strategies and glucose control in low-income patients with diabetes. *Public Health Nutrition*, 19(6), 1103–1111. doi:10.1017/S1368980015002323 [PubMed: 26328922]
- National Center for Health Statistics. (2001). Healthy people 2000 final review. <https://www.cdc.gov/nchs/data/hp2000/hp2k01.pdf>
- National Center for Health Statistics. (2021). Health of American Indian or Alaska native population. Centers for Disease Control and Prevention. <https://www.cdc.gov/nchs/fastats/american-indian-health.htm>
- National Indian Council on Aging (2019). The state of tribal elders. <https://www.nicoa.org/the-state-of-tribal-elders/>
- Noe TD, Kaufman CE, Kaufmann LJ, Brooks E, & Shore JH (2014). Providing culturally competent services for American Indian and Alaska Native veterans to reduce health care disparities. *American Journal of Public Health*, 104(S4), S548–S554. doi:10.2105/ajph.2014.302140 [PubMed: 25100420]
- Office of Minority Health. (2021a). Heart disease and American Indians/Alaska Natives. U.S. Department of Health and Human Services. <https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=34>
- Office of Minority Health. (2021b). Profile: American Indian/Alaska native. U.S. Department of Health and Human Services. <https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=62>
- Seligman HK, Jacobs EA, López A, Tschann J, & Fernandez A (2012). Food insecurity and glycemic control among low-income patients with type 2 diabetes. *Diabetes Care*, 35(2), 233–238. doi:10.2337/dc11-1627 [PubMed: 22210570]
- Smith-Kaprosy N, Martin PP, & Whitman K (2012). An overview of American Indians and Alaska Natives in the context of social security and supplemental security income. *Social Security Bulletin*, 72, 1. <https://www.ssa.gov/policy/docs/ssb/v72n4/v72n4p1.html>
- Sokolovsky J (n.d.). Status of older people: Tribal societies. [Encyclopedia.com. https://www.encyclopedia.com/education/encyclopedias-almanacs-transcripts-and-maps/status-older-people-tribal-societies](https://www.encyclopedia.com/education/encyclopedias-almanacs-transcripts-and-maps/status-older-people-tribal-societies)
- Suchy-Dacey AM, Shibata D, Best LG, Verney SP, Longstreth WT Jr., Lee ET, Okin PM, Devereux R, O'Leary M, Ali T, Jensen PN, Muller C, Nelson LA, Rhoades E, Madhyastha T, Grabowski TJ, Beauchamp N, Umans JG, & Buchwald D (2016). Cranial magnetic resonance imaging in elderly American Indians: Design, methods, and implementation of the cerebrovascular disease and its consequences in American Indians study. *Neuroepidemiology*, 47(2), 67–75. doi:10.1159/000443277 [PubMed: 27603047]
- Suchy-Dacey AM, Shibata DK, Madhyastha TM, Grabowski TJ, Longstreth WT Jr., & Buchwald DS (2017). Findings of vascular brain injury and structural loss from cranial magnetic resonance imaging in elderly American Indians: The strong heart study. *Neuroepidemiology*, 48(1–2), 39–47. doi:10.1159/000459624 [PubMed: 28259877]
- United States Government Accountability Office. (2019). Indian Health Service: Facilities reported expanding services following increases in health insurance coverage and collections (GAO-19-612). <https://www.gao.gov/products/gao-19-612>
- Urban Indian Health Institute. (2013). U.S. Census marks increase in urban American Indians and Alaska Natives. http://www.uihi.org/wp-content/uploads/2013/09/Broadcast_Census-Number_FINAL_v2.pdf
- U.S. Department of Veterans Affairs. (2010). National Survey of veterans: Final report. <https://www.va.gov/vetdata/docs/surveysandstudies/nvssurveyfinalweightedreport.pdf>

- U.S. Department of Veterans Affairs. (2012). American Indian and Alaska Native servicemembers and veterans. https://www.va.gov/TRIBALGOVERNMENT/docs/AIAN_Report_FINAL_v2_7.pdf
- U.S. Department of Veterans Affairs (2017). American Indian and Alaska native veterans: 2015 American community Survey. <https://www.va.gov/vetdata/docs/SpecialReports/AIANReport.pdf>.
- Whitesell NR, Beals J, Crow CB, Mitchell CM, & Novins DK (2012). Epidemiology and etiology of substance use among American Indians and Alaska Natives: Risk, protection, and implications for prevention. *The American Journal of Drug and Alcohol Abuse*, 38(5), 376–382. doi:10.3109/00952990.2012.694527 [PubMed: 22931069]
- Young NAE (2021). Childhood disability in the United States: 2019 (No. ACSBR-006). <https://www.census.gov/library/publications/2021/acs/acsbr-006.html>
- Young TK (1996). Recent health trends in the Native American population. In Sandefur GD, Rindfuss RR, & Cohen B (Eds.), *Changing numbers, changing needs: American Indian demography and public health*. National Academies Press. <https://www.ncbi.nlm.nih.gov/books/NBK233101/>