Journal of Asian Health

PERSPECTIVE

Achieving Equity in Asian American Health Care: Critical Issues and Solutions

Jed Keenan Obra, BS[1,2], Bryant Lin, MD, MEng[1,3], Lan N. Đoàn, PhD, MPH[4], Latha Palaniappan, MD, MS[1,3] and Malathi Srinivasan, MD[1,3]

Equity is a fundamental goal of the US health care system. Asians comprise 6% of the US population, and 60% of the world's population. Less than 1% of National Institutes of Health funding is directed toward Asian health. Asian health outcomes are often worse than non-Hispanic Whites (NHWS) in America. Increasing federal and foundation resources and funding toward Asian health research could illuminate these risks and develop precision interventions to reduce known health disparities. When disaggregated by race/ethnicity, Asian health risks are even more apparent. Here, we discuss critical health outcome differences between the six major Asian American subgroups (Asian Indian, Chinese, Filipino, Japanese, Korean, and Vietnamese) comprising 80% of the US Asian population, highlighting demographic, pharmacologic, disease prevalence, and mortality outcomes. We then outline seven critical issues contributing to Asian American health disparities, including aggregated Asian health data, undersampling, invalid extrapolations, underrepresentation in clinical trials, lack of funding and awareness of disparities, and the model minority myth. Building on the successes of national public health initiatives, we propose nine leverage points to improve Asian American health including the following: obtaining disaggregated Asian health data, improved Asian health research (oversampling Asians, improving clinical trial participation, and increasing research funding), stakeholder collaboration (national and with Asian nations), community engagement, providing culturally precise health care, and expansion of the Asian American research ecosystem. Achieving health equity takes deliberate practice and does not occur by accident. By addressing critical issues that perpetuate Asian health disparities, we grow closer to understanding how to effectively improve Asian health and build a nationally unified mindset toward action that emphasizes equitable care for all.

Key Words: Asian health ▪ health disparities ▪ health equity ▪ model minority ▪ Asian subgroups

Equity[1] is a fundamental goal of the US health care system,[2] in which individuals and populations have the necessary curated tools and resources necessary to achieve the same personal health outcomes. Over the past 20 years, progress has been made in addressing health disparities within the African American,[3] Hispanic/Latinx,[4] and Lesbian, Gay, Bisexual, Transgender, Queer (LGBTQ+)[5] communities, by first identifying differential health risks, then developing interventions to reduce those risks. While research has been rightfully focused on these communities, Asian health and health care has been largely left out of the effort to establish health equity.

The Asian American community comprises 6% of the total US population and is the fastest growing racial/ethnic group in the United States.[6] However, Asian Americans have different health risks and often worse health outcomes than the non-Hispanic White population. Characterizing these health disparities has become even more critical as xenophobia toward visible minorities has accelerated during the COVID-19 pandemic.[7] Moreover, Asian Americans are not monolithic (Table 1). Rather, drawing from origins in South Asian, East Asian, and Southeast Asian countries; Asian Americans comprise a diversity of ethnic, cultural, and racial groups, with over 70% from six countries (China, Korea, India, Japan, Thailand, and Vietnam). This heterogeneity lends itself to differential health risks, for instance with cancer,[8] diabetes,[9] and stroke.[10] To improve health outcomes through precision medicine, which takes into account an individual's genetic, environmental, and lifestyle background to determine appropriate care, we need a more focused lens on the research that will improve outcomes around Asian health.

Correspondence to: Jed Keenan Obra, Department of Neurobiology, Physiology, and Behavior, College of Biological Sciences, Life Sciences Building, Room 202, 605 Hutchinson Drive, Davis, CA 95616. Tel: 510 378 5344. Email: jlobra@ucdavis.edu

For Sources of Funding, see page 11.

Journal of Asian Health is available at https://journalofasianhealth.org

POPULAR SCIENTIFIC SUMMARY

- Asians comprise 6% of the US population, and 60% of the world's population. However, less than 1% of National Institutes of Health funding is directed toward Asian health, leading to care for Asians being based on study outcomes about non-Asians. Unfortunately, Asian health outcomes are often worse than non-Hispanic Whites (NHWS) in America. When disaggregated by race/ethnicity, Asian health risks are even more apparent.
- We discuss critical health outcome differences between the six major Asian American subgroups (Asian Indian, Chinese, Filipino, Japanese, Korean, and Vietnamese) comprising 80% of the US Asian population.
- We highlight critical demographic, pharmacologic, disease prevalence, and mortality outcomes differences for these groups.
- We also outline critical issues contributing to Asian American health disparities, including aggregated Asian health data, undersampling, invalid extrapolations, underrepresentation in clinical trials, lack of funding and awareness of disparities, and the model minority myth.
- We propose nine leverage points to improve Asian American health including: obtaining disaggregated Asian health data, improving Asian health research (oversampling Asians, improving clinical trial participation, and increasing research funding), promoting stakeholder collaboration (national and with Asian nations) and community engagement, providing culturally precise health care, and expanding the Asian American research ecosystem.

In this perspective, we share critical health outcome differences between Asian American groups, outline critical issues that must be addressed to reduce Asian health disparities, and propose an approach to improving Asian health research and education.

Table 1. Demographics of Asian Americans by country of origin.

	Country of origin	% of US population
East Asian	China	23.4
	Japan	5.3
	Korea	9.9
	Taiwan	1.4
	Mongolia	0.1
South Asian	India	19.8
	Bangladesh	0.9
	Pakistan	2.5
	Nepal	0.4
	Bhutan	0.1
	Sri Lanka	0.3
	Maldives	>0.1
Southeast Asian	Philippines	17.8
	Vietnam	10.8
	Laos	1.3
	Thailand	1.2
	Singapore	>0.1
	Malaysia	0.1
	Cambodia	1.6
	Indonesia	0.4

Source: 2010 US Census Briefs.[6]

VARIATION IN ASIAN ETHNIC SUB-GROUP HEALTH OUTCOMES

Currently, most decisions about Asian health are based on data from non-Hispanic White cohorts. Asians with origins in different countries have different metabolic, genotypic, and phenotypic traits that increase their risk to specific health outcomes. As such, Asian Americans have significantly different health outcomes for key conditions, depending on their country of origin (Table 2). Asians have higher rates of specific cancers (e.g. gastric cancer in Koreans), heart disease, and other chronic conditions, compared with their Caucasian counterparts. Specifically, Asian Indian and Filipino men have an increased risk of mortality due to heart disease,[11] and Japanese women have an increased mortality rate associated with pancreatic cancer.[12] Genotypic/phenotypic differences may also vary in efficacy for metabolizing drugs, such as those with CYP2C19 loss of function allele, which leads to decreased conversion of the anticoagulant clopidogrel[10] to its active form, leading to more strokes and heart attacks in East Asian patients. Asians with other CYP2C9 allele variations may be more likely to bleed when prescribed warfarin.[13] Furthermore, Asian Americans differ in sociocultural backgrounds, which include differences in diet,[14] educational attainment,[15] and English proficiency.[16] These genotypic/phenotypic differences may account for the higher prevalence of diabetes mellitus type 2[17] observed in Filipino and Asian Indian men (26.2 and 24.8%, respectively in comparison to the 17.9% prevalence of diabetes mellitus type 2 observed in the aggregate Asian population). While some Asian households are achieving socioeconomic success, income inequality is rising more rapidly among Asian Americans than other racial or ethnic groups,[18] raising concerns over the income disparities in Asian subgroup households. For instance, Vietnamese, Korean, and Chinese poverty rates are 10.9, 11.2, and 12.9% respectively, which is 10.3% higher than the non-Hispanic White poverty rate.[15] This income inequality parallels health disparities observed within these subgroups, since

Table 2. Demographics and health outcomes of aggregate and disaggregated Asian subgroups in the United States.

						(Examples of Asian subgroup health outcome variation)			
	US population* (margin of error)	Foreign-born population*	Median household income*	Poverty rate* (%)	Bachelor's degree or higher* (% of population ≥25 years old)	Age-adjusted mortality rate per 100,000 for pancreatic cancer in women[12]	Percentage of mortality caused by heart disease in men[11]	Age- and-BMI standardized prevalence of diabetes mellitus type 2 in men[17] (%)	Increased bleeding due to anticoagulation gene variant CYP2C19*2 (frequency %)
Non-Hispanic White	236,475,401 (±99,212)	20,328,281	$69,823	10.3	34.4	9.4	27	8.60	13.3[83]
Aggregate Asian	18,636,984 (±39,562)	12,236,195	$93,759	9.6	55.6	7.0	25.1	17.90	28.4[83]
Asian Indian	4,240,466 (±49,699)	3,007,151	$126,705	5.9	75.7	4.1	31.3	24.80	North Indian – 33.1[83] South Indian – 36.8[83]
Chinese	4,404,678 (±46,036)	3,036,492	$86,281	12.9	57.7	6.8	23.2	13.20	32[84]
Filipino	2,983,596 (±45,214)	1,925,602	$100,273	5.8	49.8	6.2	28.2	26.20	39[84]
Japanese	755,672 (±17,639)	312,537	$85,007	7.3	53.7	9.8	27.8	13.50	23[84]
Korean	1,461,843 (±29,473)	1,013,129	$76,674	11.2	58.9	8.5	19.2	16.80	28.4[85]
Vietnamese	1,873,707 (±40,947)	1,257,169	$72,161	10.9	32	4.9	17.8	9.40	24[86]

*2019 American Community Survey.[15]

Vietnamese, Korean, and Chinese Americans have a greater than 2-fold higher mortality risk of gastric and liver cancers compared with their Caucasian counterparts.[12] Improving Asian health requires identifying the critical issues inhibiting appropriate health care for Asian Americans, starting with the research basis for understanding these disparities.

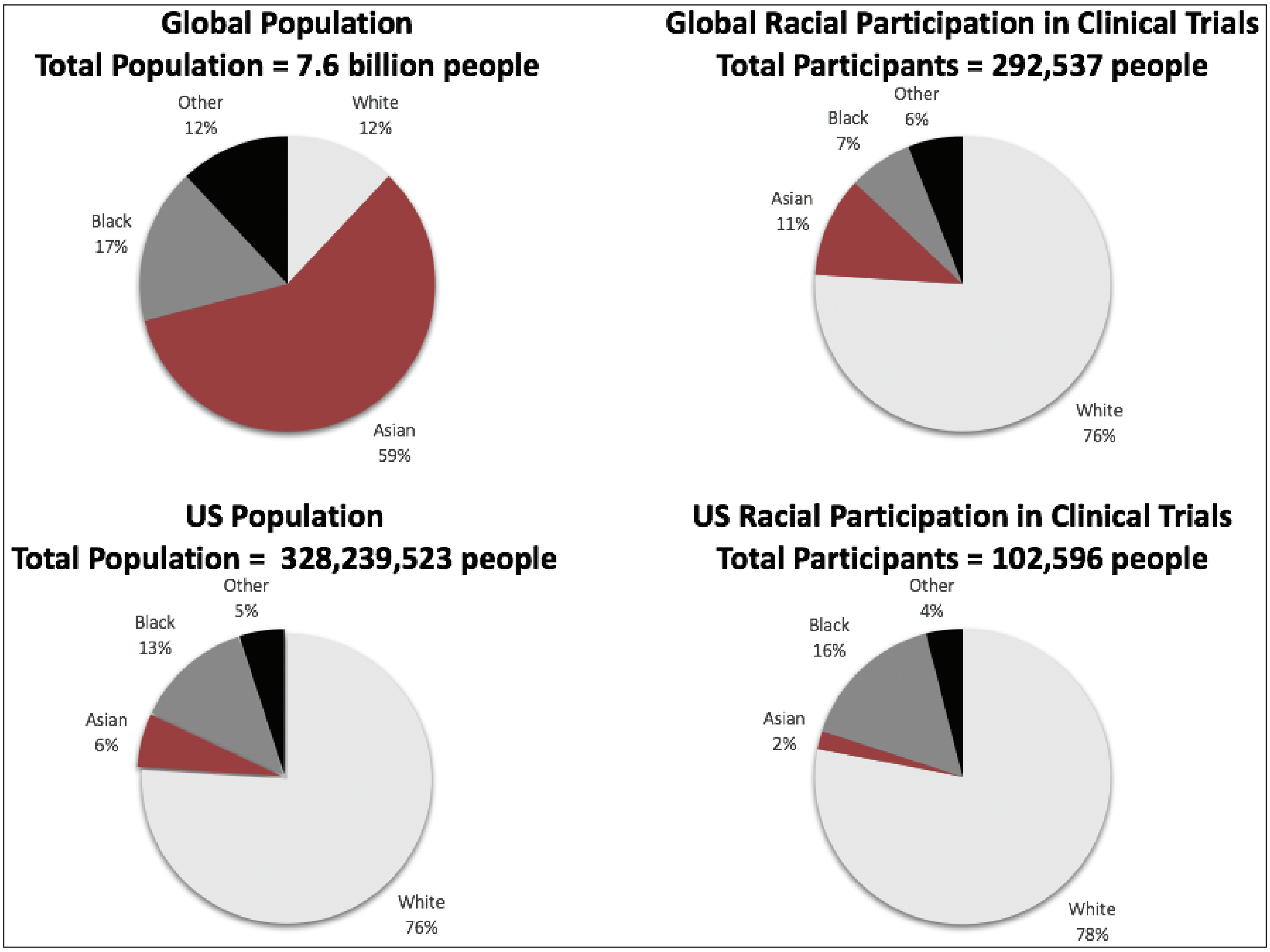
CRITICAL ISSUES IN ASIAN AMERICAN HEALTH RESEARCH

Aggregating Asian American Health Care Data. Aggregating Asian Americans as a monolith masks increased disease prevalence and culturally specific risk factors of Asian American subgroups.[9,19–21] Asians comprise 60% of the world's population. The aggregation of Asian subgroups is driven by policies of structural racism – in which diverse Asian subgroups are grouped under the umbrella 'Asian American' category when collecting demographics in national datasets, which perpetuate the misrepresentation of Asian American health. Additionally, mortality data provide important targets for earlier disease intervention.[22] In 2003, the CDC recommended that states adopt a uniform death certificate format that included six Asian subgroups.[23] However, states have implemented this new standard inconsistently over an 18-year period. In 2017, the state of Wyoming still had not disaggregated Asians on death certificate demographic data.[24] Other national organizations adopted Asian subgroup demographics information in the past 10 years. Major disease registries (i.e. US Cystic Fibrosis Foundation) still have not included Asian subgroups in their data collection. Analysis of individual electronic health record (EHR) data is critical to understand the impact of prevention and interventions for health outcomes.[20] However, health systems have not uniformly collected disaggregated Asian demographic data, as this has not been a nationally enforced data collection standard.[25] Even in California where 16% of the population is Asian, major health systems do not routinely collect demographic information about Asian subgroups. Collectively, Asian health data aggregation leads to all Asians receiving uniform treatment despite unique differences.

Undersampling in National Surveys. To adequately represent any racial/ethnic minority population in a national study, these groups must be oversampled during data collection for reliable point estimates, particularly for small populations to avoid high within-group variation. However, oversampling racial/ethnic minority groups can be challenging because of the geographic distribution of subgroups, which means researchers are often limited to small subgroup populations based on the study region.[26] For instance, the 2017 National Health Interview Survey

(NHIS) had 4% Asians in their sample, at a time when 6% of the total US population was Asian[27] – emphasizing the importance of oversampling racial/ethnic minority populations for appropriate representation of the US population at a minimum, as well as necessary sample sizes to be able to test research hypotheses. These challenges lead to inconclusive and even contradictory results for Asian Americans, which raises generalizability concerns and risks inappropriate health care diagnosis and treatment for Asian American patients. Comprehensive analyses demonstrating the leading causes of disease nationally, by disaggregated Asian American subgroups, have not been updated in 10 years.[11,12,28] Regardless, current disaggregated research reveals clear differences from the Asian American aggregate data, which demands improved epidemiological data efforts at national, state, and local levels to accurately determine differentials in health risks among these subgroups.

Omission and Lack of Asian American Representation in US Clinical Trials. Asians are underrepresented in clinical trials and are prioritized lower compared with other racial groups in clinical trial representation. Most participants in clinical trials evaluated by the US Food and Drug Administration or Food and Drug Association (FDA) to bring new drugs to market are non-Hispanic White cohorts.[29] A recent report of clinical trials involving over 130,000 patients worldwide showed that only 12% of clinical trial participants were Asian, despite making up 60% of the world's population[30] (Fig. 1). Despite efforts to include patients from minority backgrounds in clinical studies, 48% of adult trials did not meet the target recruitment goal for including underrepresented populations.[31] Inclusion of Asian Americans in clinical research trials is important to understand if there are adverse effects in newly approved or commonly used medicines in certain Asian populations. For example, allopurinol, a medication used to treat gout, can cause a severe skin disorder in patients of Han Chinese, Korean, or Thai descent with a particular genetic variant (HLA-B*58:01).[32] Other examples of drugs that are ineffective or cause severe significant side effects in Asian populations include tamoxifen[33] and carbamazepine.[34] Without appropriate emphasis and data on the unique effects of clinical trials on AA subgroup



Sources: US Food & Drug Administration, FDA, 2019[28] and US Census Bureau.[87,88]

Figure 1. Differences between global population and Asian research participation in clinical trials.

populations, there remains a clear and concerning risk for Asian patients prescribed these medications.

Poor Awareness of Asian Health Disparities. Asian health is frequently aggregated, misrepresented, or not mentioned in mainstream health literature and medical education.[20] As such, policymakers, physicians/providers, and most Asians are unaware of Asian health disparities.[35,36] With Asians primarily located in high-density populations in seven states (CA, FL, HI, IL, NJ, TX, VA, and WA),[11] policymakers have often not identified the differential health needs of the Asian American community. While there is little research on the impact of health care providers' stereotypes of Asians, Asian patients report frequent health care provider's misunderstandings of their culture,[35] which can happen especially when the encounters are not between ethnically/culturally congruent provider–patient dyads.[37] This may be due in part to provider unconscious bias, with negative implications of cognitive overload[38] and illusory correlations,[39] which increase provider susceptibility to medical decision-making based on automatic stereotypes. Additionally, Asian patients report that routine checkups and preventative care are not a norm in their countries of origin.[40] Use of complementary and alternative medicine[40] is highly ingrained within East Asian cultures, which often discourage Asians from seeking Western medical treatment. Beyond this, multilevel barriers in language accessibility,[41] transportation,[40] and health insurance[42] reduce Asian patient visits and mask the prevalence of disease within the Asian community. The lack of patient visits on a regular basis not only perpetuates the unawareness of the importance of seeking medical care early in the Asian American community but also masks disease prevalence specific to Asian American subgroups.

Extrapolation. In an absence of specific, precise data about Asian subgroups, health care provides generalized health trends from other groups using the data they have, often erroneously. For instance, the Ni-Hon-San study[43] showed Japanese men having lower rates of heart disease than their non-Hispanic White counterparts in San Francisco and Hawaii. Unfortunately, subsequent reports extrapolated these findings to all Asian subgroups,[20] masking the higher coronary heart disease (CHD) risk observed in Asian Indians and Filipinos (5.2 and 5.1% prevalence rate, respectively, in comparison to the 2.9% rate found in Japanese men and 3.9% rate in NHWS[44]). In drug trials, the FDA inaccurately extrapolated studies of Japanese subjects to all Asian patients with dosage recommendations of rosuvastatin (Crestor).[20] With Asian subgroup data often being extrapolated to the aggregate Asian group, it is important that investigators understand ethnic differences between Asians to avoid inappropriate extrapolation toward health outcomes.

The Model Minority Myth. Further masking the health difficulties of the Asian American population includes the 'model minority myth' characterization that fosters the perspective of uniform and thriving health conditions among all Asian subgroups. The myth builds an oppression toward Asian Americans by excluding them from policy considerations and provisions.[45,46] However, multiple studies[47,48] have debunked this myth by highlighting stark disparities in preventable diseases between Asians and their white counterparts, and the major socioeconomic disparities within Asian subgroups.[15] The model minority myth is not solely responsible for this lack of awareness, as clinicians and principal investigators note that patient's skepticism, socioeconomic factors, and multilevel barriers such as language and transportation hinder Asian participation in health care and research.[49–51] The absence of disaggregated data and Asian representation further perpetuates the false idealization that Asian Americans do not possess health disparities.

Funding for Asian American Research. Lack of funding in Asian American health research poses barriers for investigators to conduct projects that yield reliable and valid data. From 1992 to 2018, clinical research projects focused on Asian American, and Native Hawaiian and Pacific Islander (NHPI) populations comprised only 0.2% of the total National Institute of Health (NIH) budget.[52] Beyond NIH funding, philanthropic funding reveals no reported increase in grantmaking for 70% of Asian American communities in the last 5 years.[53] While the total amount of funding for Asian American health research has increased over time,[54] grant applications from Asian Americans, especially Asian women, were less likely than their white counterparts to be awarded funding.[19,55,56] Increasing funding is integral to the investigator's ability to make research opportunities available and accessible for the Asian American community to participate in. Other possible sources of Asian American health research funding, including non-NIH governmental agencies, private organizations, and university institutions, have not yet been compiled and evaluated to understand current investments to advance Asian health equity.

POTENTIAL SOLUTIONS TO REDUCE ASIAN AMERICAN HEALTH DISPARITIES

Achieving equity in Asian health outcomes will require the same concerted effort by stakeholders that have reduced disparities in other minority groups such as African American, Hispanic/Latinx, and LGBTQ communities. By addressing disparity challenges, we not only decrease health risks but can also significantly increase cost savings for all ethnic populations. Hepatitis B studies have found that vaccinating 170 million children in China would cost the equivalent of 540 million US dollars but would save 1.4 billion US dollars over the lifetime of the children.[57] In the United States, screening for hepatitis B costs around $36,000–$40,000 per quality-adjusted life year (QALY), which is under the $50,000–$100,000 per QALY threshold of which the United States considers an intervention to be cost-effective.[57] Prevention is almost always more cost-effective than treatment, and cost-saving interventions will decrease the cost of negligence for failing to screen preventable illnesses, which bring additional physical, emotional, and social burdens to patients and their families. Reallocating funds toward Asian health requires political interventions and is clearly worth turf efforts for its financial implications. Here, we outline potential solutions that policymakers, funding agencies, academic researchers, industry leaders, health care providers, and communities should consider (Table 3).

Study design

Disaggregating Asian Subgroups. Disaggregating Asian subgroups is critical to obtaining ethnic group level data in a manner that can improve precision health. In 2010, the Affordable Healthcare Act (ACA) legislation required all federally sponsored surveys to include standardized more detailed demographic information, including Asian subgroup data. This includes major national surveys such as the NHIS, the National Health and Nutrition Survey (NHANES), the National Medical Expenditure Panel Survey, the National Survey of Children's Health, and the National Immunization Survey. Other American minorities have successfully sensitized health systems to their needs. For instance, health systems have included separate fields for LBGTQ demographic intake information, including preferred pronouns (e.g. he/him/his) and nonbinary gender identification.[58] Major next steps might include requiring health systems to track and report disaggregated Asian and other ethnic subgroups for the Healthcare Effectiveness Data and Information Set and other national reporting surveys, concordant with ACA and 2020 Census data collection standards, and allowing identification of multiethnic heritage by participation. Once individual

Table 3. Potential solutions to reduce Asian health disparities.

Problem	Solution	Effect
Disaggregation of Asian subgroup data	▪ Recording fluctuations in incidence and prevalence of disease among Asian American subgroups with electronic health records ▪ Analyzing effects of geographic variation in Asian American health ▪ Establish a patient registry that can allow for survey outreach beyond geographical regions typically surveyed by investigators ▪ Increase grant funding and opportunities for investigators ▪ Expand and studies to include at least the six largest Asian American subgroups	▪ Influence health policy to support culturally relevant treatment protocols and re-establish priority areas for health research ▪ Increase publication count and knowledge of disaggregated Asian American health data ▪ Improve oversampling difficulties through increased survey outreach and accessibility for patients ▪ Identify specific gaps of knowledge among Asian subgroups ▪ More reliability and consistency with data collection ▪ Develop unique, culturally competent interventions to address unique disparities in health among Asian American subgroups
Clinical trial representation	▪ Utilizing focus groups to identify barriers and build intrapersonal influences ▪ Collaboration of investigators with patient advocacy groups to positively communicate benefits of clinical research ▪ Implementing health policies that establish multilingual resources to describe research studies ▪ Greater diversity of the health care workforce	▪ Encourage patients to enroll in clinical studies ▪ Increase awareness within the Asian community of the need for Asian representation in clinical trials ▪ Assess benefits and risks of particular medical treatments ▪ Decrease subject attrition and improve compliance within clinical studies ▪ Increase perspectives from ethnically diverse providers in the development of clinical trials to ensure Asian subgroup representation
Reducing the health care stigma through community engagement	▪ Collaborative efforts between policymakers/physicians/health care providers and patient advocacy groups ▪ Emphasize the importance of research participation to Asian American patients ▪ Encouraging trusted sources such as family members of Asian patients to educate the importance of preventative care ▪ Academic institution commitment to Asian American focused research/scholars	▪ Decreasing stigma among Asian patients to participate in Asian-focused health research ▪ Bring more visibility of the Asian American community to investigators ▪ Improve active communication between patient and health care provider ▪ Increasing minority representation in the biomedical workforce promotes sympathetic understandings between patients and providers of similar ethnic backgrounds ▪ Challenge the model minority myth of Asian Americans having better health outcomes than other demographics
Barriers to health care accessibility	▪ Investing in transportation waivers, community health workers, language interpreters and translated materials, and health insurance programs rather than patient compensation when modeling subject incentives ▪ Implementing health policies that establish multilingual resources to describe research studies	▪ Improve screening opportunities and health care visit frequency ▪ Bring more visibility of the Asian American community to investigators ▪ Improve willingness to participate in research studies among Asian American community
Funding for Asian American focused research	▪ Establish a public database of funding opportunities for investigators ▪ Federal investment in Asian American health ▪ Evaluate multisector partnerships and collaborations to investigate equitable investment for Asian American health research	▪ Increase awareness of research among potential donor organizations ▪ Increase grant applications, funding opportunities, project diversity, and project innovation ▪ Increasing multisector collaborations and interdisciplinary research teams

ethnic/racial demographic information is obtained during patient enrollment/check-in, investigators can utilize EHR data for assessing disease risk, treatment, and outcomes.

Oversampling. While necessary, oversampling is challenging, even with the best intent. For example, in 2011, NHANES tried to oversample Asians in larger cities by working with Asian community and advocacy groups to increase their survey respondents, but still ran into difficulties enrolling Asian patients.[26] The California Health Interview (CHIS) survey has been successful in oversampling Koreans and Vietnamese populations by utilizing geographic targeting of surname list samples,[26] encouraging many population-based studies to reference CHIS. Strategies to improve Asian subgroup oversampling include increasing interviewer abilities to conduct surveys in appropriate Asian languages,[26] utilizing geographic distribution[59] to identify higher concentrations of Asian subgroup communities, working with community groups to understand local stakeholder perspectives[60] and increased financial investment in survey outreach.[61] Successful oversampling will improve data reliability and validity specific to Asian subgroups.

Clinical Trial Representation. With Asians only representing 2% of US clinical trial participants despite composing 6% of the US population, increased efforts are necessary to accurately identify medicinal side effects most prevalent to Asians. Utilizing focus and patient advocacy groups to identify barriers,[62] social media outreach,[63] and improving patient education[64,65] is promising approaches to encourage Asian patients to participate in clinical trials. For instance, Chinese, Korean, and Vietnamese-Americans were found to be more willing to participate in clinical trials after having some guarantee of treatment effectiveness and lack of side effects from their provider.[64] Furthermore, developments of patient navigation programs have seen low clinical trial refusal (4–6%) among African American, American Indian, and Native Hawaiian patients.[66] Implementing these programs with institutional support, such as with Johns Hopkins University's EMPaCT (Enhancing Minority Participation in Clinical Trials) program where US universities have collaborated to boost minority participation in clinical trials,[67] is a promising approach to increasing Asian awareness and comfortability in regions with few or skeptical perspectives on clinical trial participation.

Community and precision medicine

Reducing the Health Care Stigma Through Community Engagement. Many Asians seek medical care only when ill,[40] are less likely to discuss stigmatizing conditions,[67] and are reluctant to participate in clinical trials.[50] Other Asians have had experiences in health care that leave them feeling marginalized.[36,68] Rebuilding trust among Asian patients who have felt alienated by the health care system requires proactive outreach to improve participation in health care and in research studies.[62,69] Through dialogue, active listening, and information sharing,[66] community organizations can effectively communicate the best intentions of investigators for the Asian community, thereby building trust in Asian communities. Culturally tailored information and policies can overcome disinformation and stigma. In 2005, Scotland's See Me campaign successfully used education interventions to correct inaccurate portrayals of mental illness, with a 17% drop after 2 years in perceptions that people with mental health issues were dangerous.[70] With funds from the California Mental Health Services Act, the California Mental Health Services Authority launched mental health initiatives that increased Californians' willingness to interact with people experiencing mental illness.[71] Families play important roles in health decisions among Asian patients, and other groups with strong multigenerational family structures, and interventions to expand decision-making beyond the provider–patient relationship to the provider–patient–family relationship may help improve adoption of better health behaviors.[65,72,73] Having health care providers who share the same ethnic background as their patients may encourage Asian patients to continue seeking health care through the establishment of trust with their provider.[40] Academic institutions (Table 4) are important stakeholders in diversifying the biomedical workforce and can increase minority representation in the health care field. New York University, Stanford University, University of California, Davis, University of California, San Francisco, University of Chicago, and Temple University are among the many institutions that have built programs focused on Asian health. Furthermore, some universities have Asian subgroup specific centers that address major health inequities, such as Stanford University's South Asian Translational Heart Initiative (SATHI) and University of California, San Francisco's Asian Health Initiative, that have conducted South Asian and Chinese health-focused research, respectively. Utilizing trusted influences among the Asian population to discuss the importance of preventative care visits is key assets to increasing Asian patient turnout and challenging the model minority myth that Asians experience uniform health outcomes.

Breaking Barriers to Health Care Accessibility. Appropriate health care has been a struggle for some less advantaged Asian patients,[40] especially around transportation and communication. Several unique opportunities have recently emerged. In 2019, The US Department of Transportation approved a $9.6 million project to improve transportation accessibilities for expanding health care, but this initiative has not prioritized underserved Asians.[74] With the rapid growth of telemedicine during the COVID-19 pandemic,[75] transportation barriers could be reduced for technology savvy patients with internet access. Directing resources

Table 4. **A sampling of academic centers and institutes focused on overall Asian health.**

Center name	Institution	Focus
Stanford Center for Asian Research and Education (CARE)	Stanford University, Palo Alto, CA	The Center for Asian Health Research and Education was founded on October 2018 to provide a common place for research, education, and clinical care support for Asians, allowing disparate faculty, staff, community members and trainees to share ideas and common resources
Stanford Asian Liver Center (ALC)	Stanford University, Palo Alto, CA	The Asian Liver Center at Stanford University addresses the disproportionately high rates of chronic hepatitis B infection and liver cancer in Asians and Asian Americans. The ultimate goal of the center is to eliminate the transmission and stigma of hepatitis B and reduce deaths from liver cancer and liver disease caused by chronic hepatitis B
Stanford South Asian Translational Heart Initiative (SSATHI)	Stanford University, Palo Alto, CA	To help South Asians better understand their risk for heart disease, the Stanford South Asian Translational Heart Initiative (SSATHI) offers health assessments and treatment strategies among other clinical services. SSATHI's research will help develop technologies to predict and treat patients who are at the highest risk of developing heart disease and prevent their disease from occurring
Asian American Health Coalition of the Greater Houston Area	HOPE Clinic, Houston, TX	Asian American Health Coalition (AAHC) was established in 1994 as a forum and a convener for rallying community resources to reduce the widening health disparity gap faced by rapidly growing Asian populations residing in the greater Houston area
Asian American Center on Disparities Research (AACDR)	University of California, Davis, Davis, CA	The mission of the Asian American Center on Disparities Research (AACDR) is focused on this aspect of disparity – ethnocultural factors that influence the effectiveness of treatment. The center supports and coordinates the efforts of a network of researchers who study the mental health issues most salient to Asian Americans
Collaborative approach for Asian Americans & Pacific Islanders Research and Education (CARE)	University of California, San Francisco, San Francisco, CA	To address the gap and reduce disparities in research participation among Asian Americans and Pacific Islanders (AAPI) through the creation of a registry of AAPI who are interested in participating in various types of research such as Alzheimer's disease and related dementias (ADRD), aging, and caregiving-related research that affects our health across the lifespan
Asian American Research Center on Health (ARCH)	University of California, San Francisco, San Francisco, CA	ARCH maintains an open and collaborative environment to carry out the vision, which is to be a leader in Asian American health research to promote health and health equity in partnership with Asian American communities
Asian Health Institute	University of California, San Francisco, San Francisco, CA	The mission of the UCSF Asian Healthcare Institute is to improve health outcomes, eliminate health care disparities in Asians, as well as increase their medical access. AHI strives to emphasize healthy lifestyle practices and preventive medicine through raising health literacy levels of the Asian American community in language- and culturally appropriate health education programs. AHI looks forward to becoming one of the strongest research, academic, and clinical Asian health care resource hubs in the nation
NYU Center for the Study of Asian American Health (CSAAH)	New York University, New York, NY	CSAAH applies innovative and rigorous approaches to harness the power of community health workers, technology, and electronic health record-based strategies in ways that have not previously been adapted or systematically tested among Asian American communities to improve access to care
Center for Asian Health	Temple University, Philadelphia, PA	The Center for Asian Health research encompasses a range of health issues that reflect both national priorities as well as scientifically identified community concerns. The Center, in cooperation with a large network of community, institutional, and clinical partners, has focused on four broad areas of health disparity research that include cancer, tobacco, cardiovascular, and chronic diseases; translational health; and global health.
Center for Asian Health Equity (CAHE)	University of Chicago Medicine, Chicago, IL	CAHE is a unique academic and community partnership between the University of Chicago and Asian Health Coalition (AHC), a community-based organization dedicated to the study of primarily Asian American health and disparities. The Center takes a multidisciplinary, collaborative approach to addressing gaps in clinical medicine and public health through a comprehensive program for research, health education, training, community engagement, policy, and information dissemination
Asian Health Initiative	Tufts Medical Center, Boston, MA	The AHI identifies public health issues of particular prevalence or concern to the local Asian community and seeks to work collaboratively with community-based organizations to help address those health issues in a culturally and linguistically appropriate setting
Healthy Mind Initiative	National Institute on Minority Health and Health Disparities, Bethesda, MA	The mission of the Healthy Mind Initiative (HMI) is to increase mental health awareness and promote suicide prevention in AAPI adolescents. Launched in 2018, HMI is a collaborative effort among the US Public Health Service, federal and county government partners, and AAPI community organizations and leadership. It highlights the importance of mental health literacy by educating about mental illness, substance misuse, and suicide among AAPI youth, with a focus on prevention and early detection
The Rutgers Asian Resource Center for Minority Aging Research (RCMAR)	Rutgers, The State University of New Jersey, New Brunswick, NJ	RCMAR aims to understand the cross-ethnic variations in the social, cultural, and behavior mechanisms of trauma, stress, and resilience across US Asian populations; it explores the differential health outcomes associated with trauma, immigration, and mechanisms of resilience in US Asian populations. In addition, it supports early-career researchers through funding, education, and training, and build community capacity to address health disparities and improve health outcomes

toward improving technological accessibility and telemedicine are strong practices to improve health care access. While interpreter services can improve communication, rigorous translator training prior to patient interpreter services to ensure that ethnic minority patient (Latinx,[76] etc.) viewpoints are appropriately represented. This becomes more relevant when interpreters of an Asian patient's dialect or language are not available. In addition, with COVID-19-related changes to American society, and an increase in Asian-specific

Table 5. **A sampling of journals focusing on overall Asian and Asian American health (not country of origin specific journals).**

Journal name	Country/editorial office	Impact factor* (JCR)	Impact factor* (SJR)
Journal of Asian Health	United States/Palo Alto	Relaunching	Relaunching
Asian Biomedicine	Thailand/Bangkok	0.324	0.2
Asian Journal of Psychiatry	Netherlands/Amsterdam	2.529	0.74
Asian Nursing Research	South Korea	0.988	0.51
Asian Journal of Surgery	Taiwan/Taipei	1.838	0.49
Asian Pacific Journal of Allergy and Immunology	Thailand/Bangkok	1.247	0.34
Asian Pacific Journal of Tropical Biomedicine	China/Hainan	1.903	0.51
Asian Pacific Journal of Tropical Medicine	China/Hainan	1.940	0.54
Asia-Pacific Journal of Public Health	Australia/Perth	1.459 (2014)	0.55
Southeast Asian Journal of Tropical Medicine and Public Health	Thailand/Bangkok	0.245	0.26
American Journal of Chinese Medicine	United States/Chicago	3.682	0.89
Asian Pacific Journal of Cancer Prevention	Iran/Tehran	2.52 (2014)	0.5

*All impact factors are from 2019 unless otherwise stated.

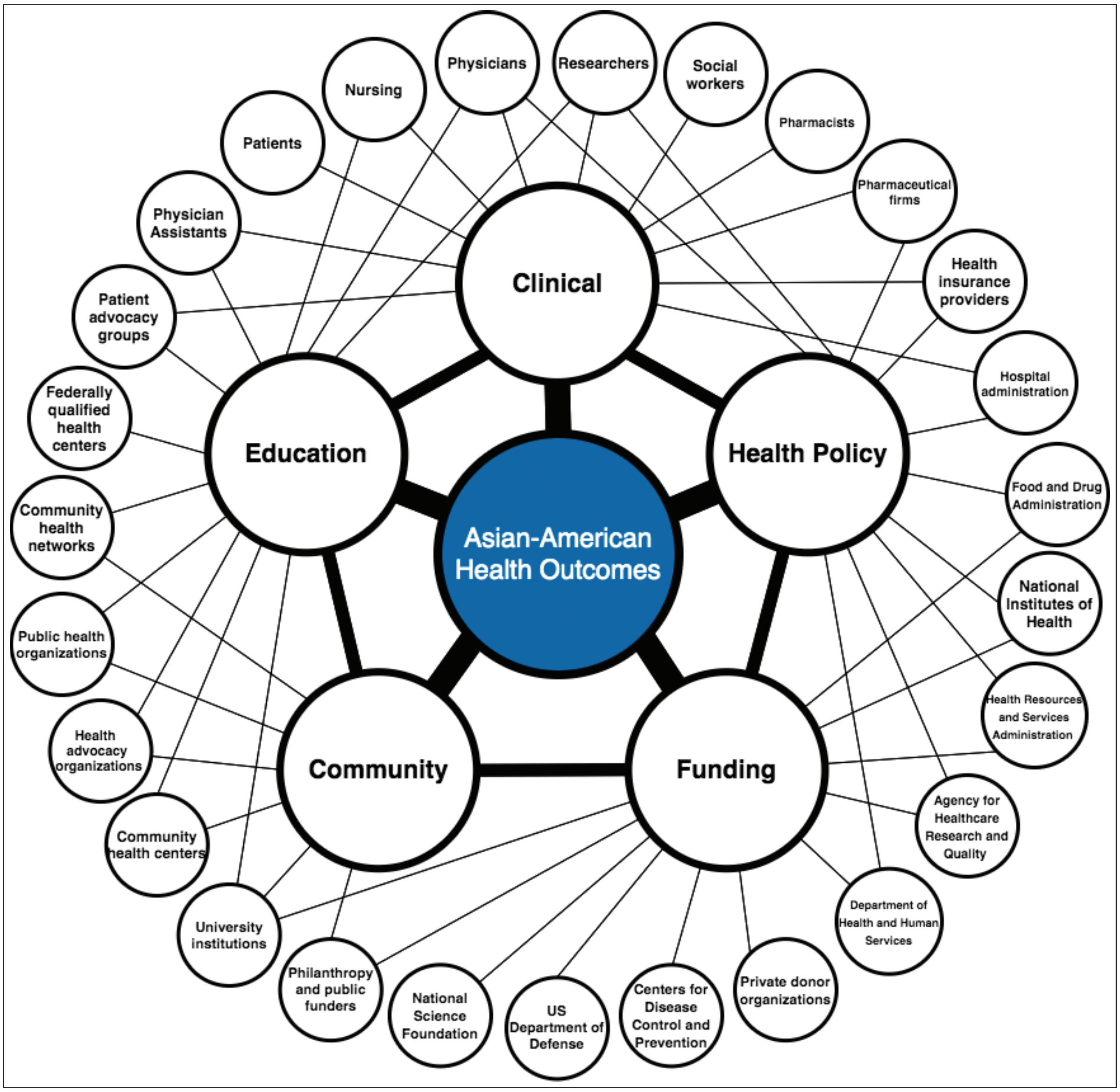


Figure 2. **Stakeholders of Asian American research.**

xenophobia, investigators should accurately reassess barriers to care faced by Asians, including access to care (transportation, insurance, and language), screening, prevention, and treatment.

Funding and collaboration

Funding for Asian American focused research. With the NIH as the primary source of funding for Asian American health research,[51] inclusion of underrepresented populations in the federal agenda is necessary for establishing long-term investments in Asian health. Funded research produces more peer-reviewed papers and increases the likelihood of being published in widely read journals, which strongly influences health literature dissemination via high citation rates.[77] Expedited clinical trials that accelerated the creation of the COVID-19 vaccine demonstrate how effective data collection can be facilitated by an increased priority of funding.[78] With increased financial support, investigators conducting Asian-American-focused research can similarly gather comprehensive data at faster rates. Funding should be sufficient to promote multi-institutional collaborations and networking between research institutions[79] and

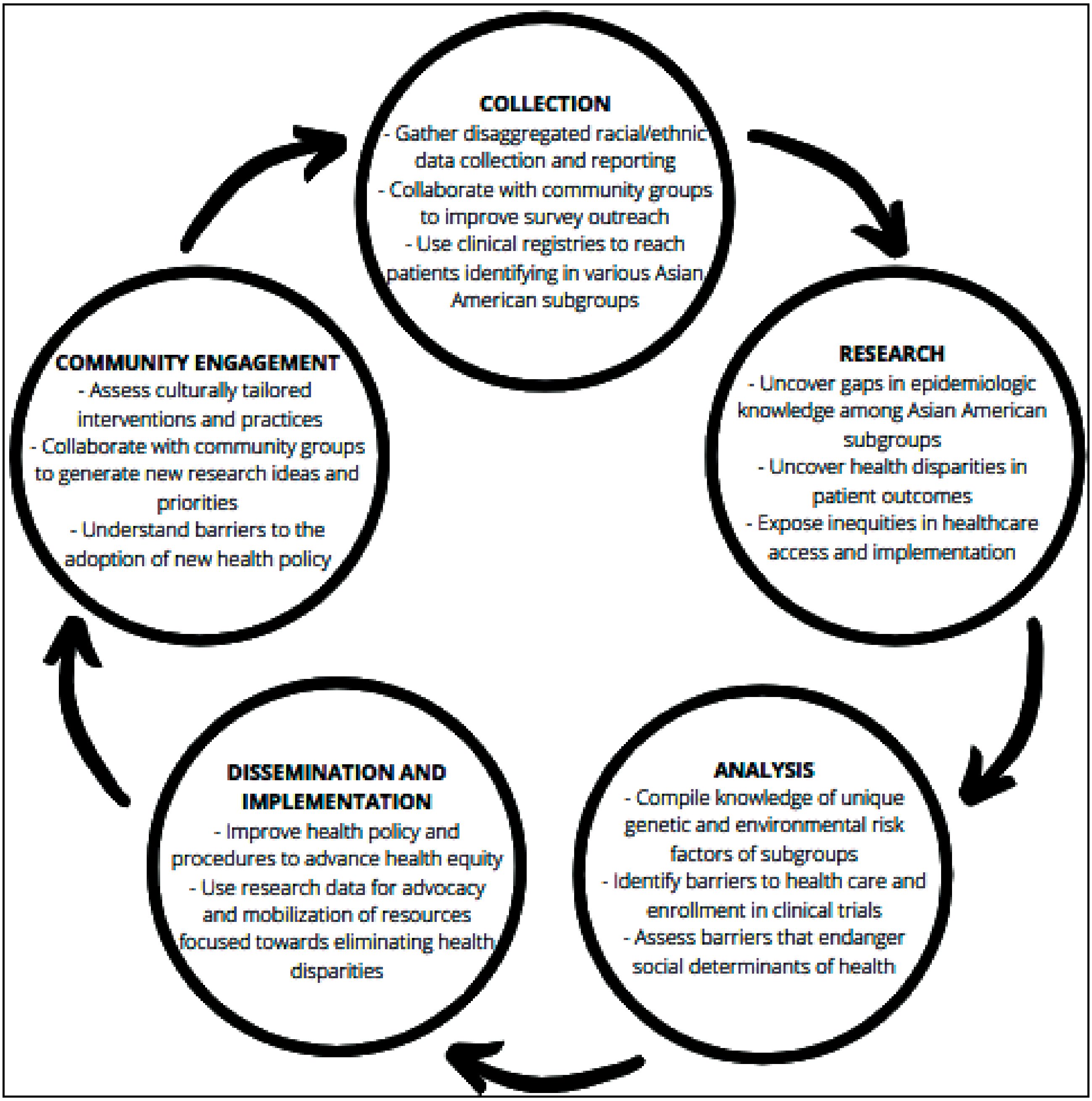


Figure 3. **Action plan for crafting effective health policy that supports long-term precision medicine.**

investigators[80] in order to ask and answer substantial questions necessary to improve Asian American health across the nation. A centralized public database of funding opportunities and grants for Asian American health-focused investigators will pave the way for increased essential research in Asian America health.

Collaborating with Asian nations. By pairing with leading country-specific health care institutions, universities, and national agencies, Asian American health researchers can understand the effects of immigration, acculturation, and conducting cross national research about relative differences in Asian health. Current international collaborations, such as the Pulmonary Vascular Research Institute and the American Thoracic Society, have been successful at increasing global awareness for pulmonary vascular disease.[81] With international collaborations increasing the likelihood of publication in high-impact journals,[82] Asian American health researchers can work toward long-term international collaboration by contacting other investigators publishing in local and international Asian-health-focused medical journals (Table 5). International collaborations should increase investigator's knowledge of differences between Asian native and immigrant populations, which may shed light on the causes for differing Asian health outcomes.

Expanding the Asian American Research Ecosystem. Making a significant change necessitates involving the stakeholders in Asian American health (Fig. 2). While coalitions among Asian American research organizations can increase opportunities for project implementations, funding, and community member participation, it is equally important to keep research community-centered and community-led to ensure that projects are meaningful and implemented appropriately. Investigators should regard community expertise as equal to 'researcher expertise' and are likewise properly compensated.[60] Improving policy on an institutional level will pave the way for nationwide awareness and action toward accurate and consistent data collection among Asian subgroups. From this, health care providers can develop and implement culturally tailored, evidence-based interventions (Fig. 3) that will not only effectively treat individual Asian patients but also build trust among the Asian community in a health care system that has seemed to ignore its health care needs.

CONCLUSIONS

Diversity is part of the American fabric. Achieving health equity takes deliberate practice and does not occur by accident. In this manuscript, we have outlined critical issues that, if addressed, can improve equity in Asian health and health outcomes. While equity is our next milestone for Asian health, beyond equity is an aspiration toward personalized, culturally competent precision medicine, which values each person in their culture, socioeconomic background, their similarities and differences. As we steadily grow closer to understanding the means to effectively improve Asian health, we establish a more national solid mindset toward action that emphasizes equitable care for all.

ARTICLE INFORMATION

Received February 02, 2021; accepted May 25, 2021.

Affiliations

[1]Stanford Center for Asian Research and Education, Stanford University School of Medicine; Palo Alto, CA; [2]Department of Neurobiology, Physiology, and Behavior, University of California Davis; Davis, CA; [3]Department of Medicine, Stanford University School of Medicine; Palo Alto, CA; [4]Department of Population Health, NYU Grossman School of Medicine; New York, NY

Conflict of interest and funding

This publication is supported by the Stanford Center for Asian Research and Education, National Institutes of Health (NIH), National Institute on Minority Health and Health Disparities (U54MD000538), and Centers for Disease Control and Prevention (CDC, NU38OT2020001477). The authors report no conflict of interest. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of the NIH or the CDC.

REFERENCES

1. Braveman P. What are health disparities and health equity? We need to be clear. *Public Health Rep.* 2014;129(Suppl 2):5–8. doi: 10.1177/00333549141291S203
2. Assistant Secretary for Planning and Evaluation (ASPE). Overview: HHS Strategic Plan, FY 2018–2022. U.S. Department of Health & Human Services Website. Published February 28, 2018. Available from: https://www.hhs.gov/about/strategic-plan/overview/index.html [cited 27 January 2021]
3. Noonan AS, Velasco-Mondragon HE, Wagner FA. Improving the health of African Americans in the USA: an overdue opportunity for social justice. *Public Health Rev.* 2016;37:12. doi: 10.1186/s40985-016-0025-4
4. Avilés-Santa ML, Hsu L, Lam TK, Arteaga SS, Artiles L, Coady S, Cooper LS, Curry J, Desvigne-Nickens P, Nicastro HL, Rosario A. Funding of Hispanic/Latino health-related research by the national institutes of health: an analysis of the portfolio of research program grants on six health topic areas. *Front Public Health.* 2020;8:330. doi: 10.3389/fpubh.2020.00330
5. Coulter RWS, Kenst KS, Bowen DJ, Scout N. Research funded by the national institutes of health on the health of lesbian, gay, bisexual, and transgender populations. *Am J Public Health.* 2014;104(2):e105-e112. doi: 10.2105/AJPH.2013.301501
6. Hoeffel E, Rastogi S, Kim MO, Shahid H. The Asian Population: 2010. U.S. Census Bureau website. Published March 2012. Available from: https://www.census.gov/prod/cen2010/briefs/c2010br-11.pdf [cited 25 January 2020]
7. Wang D, Gee GC, Bahiru E, Yang EH, Hsu JJ. Asian-Americans and Pacific Islanders in COVID-19: emerging disparities amid discrimination. *J Gen Intern Med.* 2020;35(12):3685–3688. doi: 10.1007/s11606-020-06264-5
8. Torre LA, Goding Sauer AM, Chen MS, Kagawa-Singer M, Jemal A, Siegel RL. Cancer Statistics for Asian Americans, Native Hawaiians, and Pacific Islanders, 2015: convergence of incidence between males and females. *CA Cancer J Clin.* 2016;66(3):182–202. doi: 10.3322/caac.21335
9. Gordon NP, Lin TY, Rau J, Lo JC. Aggregation of Asian-American subgroups masks meaningful differences in health and health risks among Asian ethnicities: an electronic health record based cohort study. *BMC Public Health.* 2019;19(1):1551. doi: 10.1186/s12889-019-7683-3
10. Pan Y, Chen W, Xu Y, Yi X, Han Y, Yang Q, Li X, Huang L, Johnston SC, Zhao X, Liu L, Zhang Q, Wang G, Wang Y, Wang Y. Genetic polymorphisms and clopidogrel efficacy for acute ischemic stroke or transient ischemic attack. *Circulation.* 2017;135(1):21–33. doi: 10.1161/CIRCULATIONAHA.116.024913

11. Hastings KG, Jose PO, Kapphahn KI, Frank ATH, Goldstein BA, Thompson CA, Eggleston K, Cullen MR, Palaniappan LP. Leading causes of death among Asian American subgroups (2003–2011). *PLoS One*. 2015;10(4):e0124341. doi: 10.1371/journal.pone.0124341
12. Thompson CA, Gomez SL, Hastings KG, Kapphahn K, Yu P, Shariff-Marco S, Bhatt AS, Wakelee HA, Patel MI, Cullen MR, Palaniappan LP. The burden of cancer in Asian Americans: a report of national mortality trends by Asian ethnicity. *Cancer Epidemiol Biomark Prev*. 2016;25(10):1371–1382. doi: 10.1158/1055-9965.EPI-16-0167
13. Lee SC, Ng SS, Oldenburg J, Chong PY, Rost S, Guo JY, Yap HL, Rankin SC, Khor HB, Yeo TC, Ng KS, Soong R, Goh BC. Interethnic variability of warfarin maintenance requirement is explained by VKORC1 genotype in an Asian population. *Clin Pharmacol Ther*. 2006;79(3):197–205. doi: 10.1016/j.clpt.2005.11.006
14. Konkel L. The 'typical' Asian diet is anything but: differences in dietary exposure to metals among subgroups of U.S. Asians. *Environ Health Perspect*. 2017;125(3):A58–A59. doi: 10.1289/ehp.125-A58
15. U.S. Census Bureau. Table S0201: Selected Population Profile in the United States, American Community Survey 1-Year Estimates, 2019. Washington, DC: U.S. Census Bureau. Available from: https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2019/1-year.html [cited 12 January 2021]
16. Dong X. Achieving health equity in Asian populations. *Gerontol Geriatr Med*. 2018;4:2333721418778169. doi: 10.1177/2333721418778169
17. Wang EJ, Wong EC, Dixit AA, Fortmann SP, Linde RB, Palaniappan LP. Type 2 diabetes: identifying high risk Asian American subgroups in a clinical population. *Diabetes Res Clin Pract*. 2011;93(2):248–254. doi: 10.1016/j.diabres.2011.05.025
18. Lopez G, Ruiz N, Patten E. Key facts about Asian Americans. Pew Research Center Website. Published September 8, 2017. Available from: https://www.pewresearch.org/fact-tank/2017/09/08/key-facts-about-asian-americans/ [cited 12 January 2021]
19. Dong X. Advancing Asian health equity: multimodal approach to translate research into practice and policy. *J Am Geriatr Soc*. 2019;67(S3):S476–S478. doi: 10.1111/jgs.16110
20. Holland AT, Palaniappan LP. Problems with the collection and interpretation of Asian-American health data: omission, aggregation, and extrapolation. *Ann Epidemiol*. 2012;22(6):397–405. doi: 10.1016/j.annepidem.2012.04.001
21. Palaniappan LP, Araneta MRG, Assimes TL, Barrett-Connor EL, Carnethon MR, Criqui MH, Fung GL, Narayan KMV, Patel H, Taylor-Piliae RE, Wilson PWF, Wong ND. Call to action: cardiovascular disease in Asian Americans: a science advisory from the American Heart Association. *Circulation*. 2010;122(12):1242–1252. doi: 10.1161/CIR.0b013e3181f22af4
22. Baker R, Sullivan E, Camosso-Stefinovic J, Rashid A, Farooqi A, Blackledge H, Allen J. Making use of mortality data to improve quality and safety in general practice: a review of current approaches. *Qual Saf Health Care*. 2007;16(2):84–89. doi: 10.1136/qshc.2006.019885
23. National Center for Health Statistics. NVSS – Revisions of the U.S. Standard Certificates and Reports. Centers for Disease Control and Prevention website. Published September 4, 2019. Available from: https://www.cdc.gov/nchs/nvss/revisions-of-the-us-standard-certificates-and-reports.htm [cited 27 January 2021]
24. Tripathi O, He Y, Han B, Paragas DG, Sharp N, Srinivasan, M, Palaniappan LP, Thompson CA. Cancer mortality in US-born vs. Foreign-born Asian American Groups (2008–2017). *Cancer Epidemiol Biomarkers Prev*. (under review)
25. Rubin V. Counting a Diverse Nation: Disaggregating Data on Race and Ethnicity to Advance a Culture of Health. Robert Wood Johnson Foundation. Available from: https://www.policylink.org/resources-tools/counting-a-diverse-nation [cited 27 January 2021]
26. Ponce N, Scheitler AJ, Shimkhada R. Understanding the culture of health for Asian American, Native Hawaiian and Pacific Islanders (AANHPIs): what do population-based health surveys across the nation tell us about the state of data disaggregation for AANHPIs? Robert Wood Johnson Foundation. Published July 2016. Available from: http://www.policylink.org/sites/default/files/AANHPI-draft-Report-9-262016.pdf [cited 12 January 2021]
27. National Center for Health Statistics. NHIS – 2017 Data Release. Centers for Disease Control and Prevention website. Published May 10, 2019. Available from: https://www.cdc.gov/nchs/nhis/nhis_2017_data_release.htm [cited 27 January 2021]
28. Printz C. Cancer mortality rates vary among specific Asian American ethnic groups. *Cancer*. 2017;123(1):11. doi: 10.1002/cncr.30486
29. Lolic M, Okeke M, Menschik D, Fleischer J. 2015–2019 Drug Trials Snapshots Summary Report. U.S. Food & Drug Administration Website. Published online January 12, 2021. Available from: https://www.fda.gov/drugs/drug-approvals-and-databases/drug-trials-snapshots [cited 12 January 2021]
30. United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects 2019 – Volume II: Demographic Profiles. New York City, NY: UN; 2020.
31. Mak WWS, Law RW, Alvidrez J, Pérez-Stable EJ. Gender and ethnic diversity in NIMH-funded clinical trials: review of a decade of published research. *Adm Policy Ment Health*. 2007;34(6):497–503. doi: 10.1007/s10488-007-0133-z
32. Dean L, Allopurinol therapy and HLA-B*58:01 genotype. In: Pratt V, McLeod H, Rubinstein W, Dean L, Kattman B, Malheiro A, eds. Medical Genetics Summaries. Bethesda, MD: National Center for Biotechnology Information; 2012-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK127547/ [cited January 12 2021]
33. Lo C, Nguyen S, Yang C, Witt L, Wen A, Liao TV, Nguyen J, Lin B, Altman RB, Palaniappan L. Pharmacogenomics in Asian subpopulations and impacts on commonly prescribed medications. *Clin Transl Sci*. 2020;13(5):861–870. doi: 10.1111/cts.12771
34. Ferrell PB, McLeod HL. Carbamazepine, HLA-B*1502 and risk of Stevens–Johnson syndrome and toxic epidermal necrolysis: US FDA recommendations. *Pharmacogenomics*. 2008;9(10):1543–1546. doi: 10.2217/14622416.9.10.1543
35. Ngo-Metzger Q, Legedza ATR, Phillips RS. Asian Americans' reports of their health care experiences. *J Gen Intern Med*. 2004;19(2):111–119. doi: 10.1111/j.1525-1497.2004.30143.x
36. Koh H, Park JJ. Health equity matters for Asian Americans, Native Hawaiians, and Pacific Islanders. *JAMA Health Forum.* Available from: https://jamanetwork.com/channels/health-forum/fullarticle/2760153 [cited 12 January 2021]
37. Náfrádi L, Nakamoto K, Schulz PJ. Is patient empowerment the key to promote adherence? A systematic review of the relationship between self-efficacy, health locus of control and medication adherence. *PLoS One*. 2017;12(10):e0186458. doi: 10.1371/journal.pone.0186458
38. Burgess DJ. Are providers more likely to contribute to healthcare disparities under high levels of cognitive load? How features of the healthcare setting may lead to biases in medical decision making. *Med Decis Making*. 2010;30(2):246–257. doi: 10.1177/0272989X09341751
39. Ho IK, Lawrence JS. The role of social cognition in medical decision making with Asian American Patients. *J Racial Ethn Health Disparities*. 2020;1–7. doi: 10.1007/s40615-020-00867-8
40. Lee S, Martinez G, Ma GX, Hsu CE, Robinson ES, Bawa J, Juon H. Barriers to health care access in 13 Asian American communities. *Am J Health Behav*. 2010;34(1):21–30. doi: 10.5993/ajhb.34.1.3
41. Ngo-Metzger Q, Massagli MP, Clarridge BR, Manocchia M, Davis RB, Iezzoni LI, Phillips RS. Linguistic and cultural barriers to care. *J Gen Intern Med*. 2003;18(1):44–52. doi: 10.1046/j.1525-1497.2003.20205.x
42. Ye J, Mack D, Fry-Johnson Y, Parker K. Health care access and utilization among US-born and Foreign-born Asian Americans. *J Immigr Minor Health*. 2012;14(5):731–737. doi: 10.1007/s10903-011-9543-9
43. Marmot MG, Syme SL, Kagan A, Kato H, Cohen JB, Belsky J. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California: prevalence of coronary and hypertensive heart disease and associated risk factors. *Am J Epidemiol*. 1975;102(6):514–525. doi: 10.1093/oxfordjournals.aje.a112189
44. Holland AT, Wong EC, Lauderdale DS, Palaniappan LP. Spectrum of cardiovascular diseases in Asian-American racial/ethnic subgroups. *Ann Epidemiol*. 2011;21(8):608–614. doi: 10.1016/j.annepidem.2011.04.004
45. Chao MM, Chiu C, Lee JS. Asians as the model minority: Implications for US Government's policies. *Asian J Soc Psychol*. 2010;13(1):44–52. doi: 10.1111/j.1467-839X.2010.01299.x
46. Shih KY, Chang TF, Chen SY. Impacts of the model minority myth on Asian American individuals and families: social justice and critical race feminist perspectives. *J Fam Theory Rev*. 2019;11:412–428. doi: 10.1111/jftr.12342
47. Tendulkar SA, Hamilton RC, Chu C, Arsenault L, Duffy K, Huynh V, Hung M, Lee E, Jane S, Friedman E. Investigating the myth of the 'model minority': a participatory community health assessment of Chinese and Vietnamese adults. *J Immigr Minor Health*. 2012;14(5):850–857. doi: 10.1007/s10903-011-9517-y
48. Chen MS, Hawks BL. A debunking of the myth of healthy Asian Americans and Pacific Islanders. *Am J Health Promot*. 1995;9(4):261–268. doi: 10.4278/0890-1171-9.4.261
49. Durant RW, Wenzel JA, Scarinci IC, Paterniti DA, Fouad MN, Hurd TC, Martin MY. Perspectives on barriers and facilitators to minority recruitment

for clinical trials among cancer center leaders, investigators, research staff, and referring clinicians: enhancing minority participation in clinical trials (EMPaCT). *Cancer*. 2014;120 (Suppl 7):1097–1105. doi: 10.1002/cncr.28574

50. Umutyan A, Chiechi C, Beckett LA, Paterniti DA, Turrell C, Gandara DR, Davis SW, Wun T, Chen MS Jr, Lara PN Jr. Overcoming barriers to cancer clinical trial accrual. *Cancer*. 2008;112(1):212–219. doi: 10.1002/cncr.23170
51. Liu Y, Elliott A, Strelnick H, Aguilar-Gaxiola S, Cottler LB. Asian Americans are less willing than other racial groups to participate in health research. *J Clin Transl Sci*. 2019;3(2–3):90–96. doi: 10.1017/cts.2019.372
52. Đoàn LN, Takata Y, Sakuma K-LK, Irvin VL. Trends in clinical research including Asian American, Native Hawaiian, and Pacific Islander participants funded by the US National Institutes of Health, 1992 to 2018. *JAMA Netw Open*. 2019;2(7):e197432. doi: 10.1001/jamanetworkopen.2019.7432
53. Ramakrishnan K, Do M, Shao S. State of Philanthropy among Asian Americans and Pacific Islanders: Findings and Recommendations to Strengthen Visibility and Impact. AAPI Data and the Center for Social Innovation Website. Published September 2020. Available from: https://aapidata.com/wp-content/uploads/2020/09/aapi-state-of-philanthropy-2020-report.pdf [cited 12 January 2021]
54. Ghosh C. A national health agenda for Asian Americans and Pacific Islanders. *JAMA*. 2010;304(12):1381. doi: 10.1001/jama.2010.1358
55. Ginther DK, Schaffer WT, Schnell J, Masimore B, Liu F, Haak LL, Kington R. Race, ethnicity, and NIH research awards. *Science*. 2011;333(6045):1015–1019. doi: 10.1126/science.1196783
56. Ginther DK, Kahn S, Schaffer WT. Gender, race/ethnicity, and National Institutes of Health R01 research awards: is there evidence of a double bind for women of color? *Acad Med*. 2016;91(8):1098–1107. doi: 10.1097/ACM.0000000000001278
57. Hutton DW, Brandeau ML, So SK. Doing good with good OR: supporting cost-effective hepatitis B interventions. *Interfaces (Providence)*. 2011;41(3):289–300. doi: 10.1287/inte.1100.0511
58. Grasso C, McDowell MJ, Goldhammer H, Keuroghlian AS. Planning and implementing sexual orientation and gender identity data collection in electronic health records. *J Am Med Inform Assoc*. 2018;26(1):66–70. doi: 10.1093/jamia/ocy137
59. Chen S, Kalton G. Geographic oversampling for race/ethnicity using data from the 2010 U.S. population census. *J Surv Stat Methodol*. 2015;3(4):543–565. doi: 10.1093/jssam/smv023
60. Matthews AK, Castillo A, Anderson E, Willis M, Choure W, Rak K, Ruiz R. Ready or not? Observations from a long-standing community engagement advisory board about investigator competencies for community-engaged research. *J Clin Transl Sci*. 2018;2(3):129–134. doi: 10.1017/cts.2018.21
61. Vaughan R. Oversampling in health surveys: why, when, and how? *Am J Public Health*. 2017;107(8):1214–1215. doi: 10.2105/AJPH.2017.303895
62. Hussain-Gambles M, Leese B, Atkin K, Brown J, Mason S, Tovey P. Involving South Asian patients in clinical trials. *Health Technol Assess*. 2004;8(42):iii–109. doi: 10.3310/hta8420
63. Arigo D, Pagoto S, Carter-Harris L, Lillie SE, Nebeker C. Using social media for health research: methodological and ethical considerations for recruitment and intervention delivery. *Digit Health*. 2018;4:2055207618771757. doi: 10.1177/2055207618771757
64. Ma GX, Seals B, Tan Y, Wang SY, Lee R, Fang CY. Increasing Asian American participation in clinical trials by addressing community concerns. *Clin Trials Lond Engl*. 2014;11(3):328–335. doi: 10.1177/1740774514522561
65. Tu SP, Chen H, Chen A, Lim J, May S, Drescher C. Clinical trials: understanding and perceptions of female Chinese-American cancer patients. *Cancer*. 2005;104(12 Suppl):2999–3005. doi: 10.1002/cncr.21524
66. Ghebre RG, Jones LA, Wenzel J, Martin MY, Durant R, Ford JG. State-of-the-science of patient navigation as a strategy for enhancing minority clinical trial accrual. *Cancer*. 2014;120(S7):1122–1130. doi: 10.1002/cncr.28570
67. Kramer EJ, Kwong K, Lee E, Chung H. Cultural factors influencing the mental health of Asian Americans. *West J Med*. 2002;176(4):227–231.
68. Benner AD, Kim SY. Experiences of discrimination among Chinese American adolescents and the consequences for socioemotional and academic development. *Dev Psychol*. 2009;45(6):1682–1694. doi: 10.1037/a0016119
69. Gany F, Palaniappan L, Prasad L, Acharya S, Leng J. South Asian health. From research to practice and policy: an overview. *J Immigr Minor Health*. 2019;21(Suppl 1):3–6. doi: 10.1007/s10903-017-0552-1
70. Dunion L, Gordon L. Tackling the attitude problem. The achievements to date of Scotland's 'see me' anti-stigma campaign. *Ment Health Today*. 2005;22–25.
71. Collins RL, Wong EC, Roth E, Cerully JL, Marks J. Changes in mental illness stigma in California during the statewide stigma and discrimination reduction initiative. *Rand Health Q*. 2015;5(2):10. doi: 10.7249/RR1139
72. Ni L, Xiao Z, Liu W, Wang Q. Relationship management as antecedents to public communication behaviors: examining empowerment and public health among Asian Americans. *Public Relat Rev*. 2019;45(5):101835. doi: 10.1016/j.pubrev.2019.101835
73. Ma GX. Barriers to the use of health services by Chinese Americans. *J Allied Health*. 2000;29(2):64–70.
74. Federal Transit Administration. U.S. Department of Transportation Announces $9.6 Million to Improve Transportation Access to Health Care. Federal Transit Administration Website. Published May 22, 2019. Available from: https://www.transit.dot.gov/about/news/us-department-transportation-announces-96-million-improve-transportation-access-health [cited 20 January 2021]
75. Kichloo A, Albosta M, Dettloff K, Wani F, El-Amir Z, Singh J, Aljadah M, CHakinala RC, Kanugula AK, Solanki S, Chugh S. Telemedicine, the current COVID-19 pandemic and the future: a narrative review and perspectives moving forward in the USA. *Fam Med Community Health*. 2020;8(3):e000530. doi: 10.1136/fmch-2020-000530
76. Sanchez GR, Vargas ED. Language bias and self-rated health status among the Latino population: evidence of the influence of translation in a wording experiment. *Qual Life Res*. 2016;25(5):1131–1136. doi: 10.1007/s11136-015-1147-8
77. Álvarez-Bornstein B, Bordons M. Is funding related to higher research impact? Exploring its relationship and the mediating role of collaboration in several disciplines. *J Informetr*. 2021;15(1):101102. doi: 10.1016/j.joi.2020.101102
78. Kim JH, Marks F, Clemens JD. Looking beyond COVID-19 vaccine phase 3 trials. *Nat Med*. 2021:1–7. doi: 10.1038/s41591-021-01230-y
79. Hammond CD. Dynamics of higher education research collaboration and regional integration in Northeast Asia: a study of the A3 Foresight Program. *High Educ*. 2019;78(4):653–668. doi: 10.1007/s10734-019-00363-x
80. Ebadi A, Schiffauerova A. How to receive more funding for your research? Get connected to the right people!. *PLoS One*. 2015;10(7):e0133061. doi: 10.1371/journal.pone.0133061
81. Butrous G. International research collaboration: the key to combating pulmonary vascular diseases in the developing world. *Pulm Circ*. 2015;5(3):413–414. doi: 10.1086/682961
82. Chen TJ, Chen YC, Hwang SJ, Chou LF. International collaboration of clinical medicine research in Taiwan, 1990–2004: a bibliometric analysis. *J Chin Med Assoc*. 2007;70(3):110–116. doi: 10.1016/S1726-4901(09)70340-5
83. Gurusamy U, Shewade DG. Chapter 46 – Pharmacogenomics in India. In: Padmanabhan S, ed. *Handbook of Pharmacogenomics and Stratified Medicine*. London: Academic Press; 2014, pp. 1037–1059. doi: 10.1016/B978-0-12-386882-4.00046-3
84. Goldstein JA, Ishizaki T, Chiba K, de Morais SM, Bell D, Krahn PM, Evans DA. Frequencies of the defective CYP2C19 alleles responsible for the mephenytoin poor metabolizer phenotype in various Oriental, Caucasian, Saudi Arabian and American black populations. *Pharmacogenetics*. 1997;7(1):59–64. doi: 10.1097/00008571-199702000-00008
85. Kim KA, Song WK, Kim KR, Park JY. Assessment of CYP2C19 genetic polymorphisms in a Korean population using a simultaneous multiplex pyrosequencing method to simultaneously detect the CYP2C19*2, CYP2C19*3, and CYP2C19*17 alleles. *J Clin Pharm Ther*. 2010;35(6):697–703. doi: 10.1111/j.1365-2710.2009.01069.x
86. Yamada S, Onda M, Kato S, Matsuda N, Matsuhisa T, Yamada N, Miki M, Matsukura N. Genetic differences in CYP2C19 single nucleotide polymorphisms among four Asian populations. *J Gastroenterol*. 2001;36(10):669–672. doi: 10.1007/s005350170029
87. United States Census Bureau. Population Clock: World. U.S. Census Bureau Website. Available from: https://www.census.gov/popclock/world [cited 12 January 2021]
88. United States Census Bureau. QuickFacts: United States. U.S. Census Bureau Website. Available from: https://www.census.gov/quickfacts/fact/table/US/PST045219 [cited 13 January 2021]