

TRANSCULTURAL DIABETES CARE IN THE UNITED STATES – A POSITION STATEMENT BY THE AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS

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This document represents the official position of the American Association of Clinical Endocrinologists and American College of Endocrinology. Where there were no randomized controlled trials or specific U.S. FDA labeling for issues in clinical practice, the participating clinical experts utilized their judgment and experience. Every effort was made to achieve consensus among the committee members. Position statements are meant to provide guidance, but they are not to be considered prescriptive for any individual patient and cannot replace the judgment of a clinician.

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ABSTRACT

The American Association of Clinical Endocrinologists (AACE) has created a transculturalized diabetes chronic disease care model that is adapted for patients across a spectrum of ethnicities and cultures. AACE has conducted several transcultural activities on global issues in clinical endocrinology and completed a 3-city series of conferences in December 2017 that focused on diabetes care for ethnic minorities in the U.S. Proceedings from the “Diabetes Care Across America” series of transcultural summits are presented here. Information from community leaders, practicing health care professionals, and other stakeholders in diabetes care is analyzed according to biological and environmental factors. Four specific U.S. ethnicities are detailed: African Americans, Latino/Hispanics, Asian Americans, and Native Americans. A core set of recommendations to culturally adapt diabetes care is presented that emphasizes culturally appropriate terminology, transculturalization of white papers, culturally adapting clinic infrastructure, flexible office hours, behavioral medicine—especially motivational interviewing and building trust—culturally competent nutritional messaging and health literacy, community partnerships for care delivery, technology innovation, clinical trial recruitment and retention of ethnic minorities, and more funding for scientific studies on epigenetic mechanisms of cultural impact on disease expression. It is hoped that through education, research, and clinical practice enhancements, diabetes care can be optimized in terms of precision and clinical outcomes for the individual and U.S. population as a whole. (*Endocr Pract.* 2019;25:729-765)

LAY ABSTRACT

The American Association of Clinical Endocrinologists (AACE) has created a diabetes care model for patients of different backgrounds. AACE led meetings in New York, Houston, and Miami with health care professionals and community leaders to improve diabetes care. Information from these meetings looked at biological and environmental diabetes risks. Four American patient groups were studied: African Americans, Latinos, Asian Americans, and Native Americans. Diabetes care should use culturally appropriate language and search for better ways to apply science and clinic design. Talking to patients more clearly can improve their diabetes control. There are many other needed changes in the American health care system discussed in this paper. It is hoped that through better education, research, and practice, diabetes care can be improved for the entire U.S. population. This means that important differences among patients’ ethnic and cultural backgrounds are addressed.

EXECUTIVE SUMMARY

1. Cultural adaptation of evidence-based recommendations is a necessary component of optimal diabetes care.
2. Biological factors that contribute to the pathophysiology of diabetes vary according to race and ethnicity and can be affected by social determinants that vary with culture.
3. The “Transcultural Diabetes Nutrition Algorithm” was developed in 2010 to optimize diabetes nutrition care globally and represents a validated methodology where evidence-based recommendations from a source culture can be adapted and implemented in a different culture using a toolkit.
4. The 2015 AACE Pan-American Workshop examined diabetes care in 9 Latin American nations and concluded that there should only be one level of diabetes care for a population and that level should be “excellent;” also, that A1C measurements should be utilized and that more educational and nutritional options are needed to optimize diabetes care.
5. The “Diabetes Care Across America – A Series of Transcultural Summits” was an AACE program conducted in 2017 in New York, Houston, and Miami to examine cultural factors that influence diabetes care domestically; the findings of this program are presented here.
6. The African American, Hispanic/Latino, Asian American, and Native American populations are each comprised of different ancestries, anthropometrics/body compositions and physical appearances, and cultures and degrees of acculturation, with a significant evidence base that associates specific gene variants with specific phenotypic traits affecting diabetes care.
7. For each ethno-cultural population, health messaging and diabetes care will need to consider issues of potential distrust of health care professionals, history of discrimination, religious practices, food preferences, attitudes toward physical activity, and despite the full range of socio-economics, the impact of poverty on engagement, self-monitoring, adherence with lifestyle and medical recommendations, and recruitment for clinical trials.
8. Diabetes care should be as precise as possible, incorporating clinical trial evidence that best reflects the ethno-cultural attributes of a specific patient, with particular emphasis on cardiovascular disease risk mitigation, technology to assess the effects of eating patterns on glycemic status, adjusting traditional eating patterns to more healthy options that are still acceptable to the patient, flexibility in lifestyle and

medication recommendations that take into account cultural factors, and the utilization of community-based resources to improve implementation.

9. Pragmatic first steps to prepare a diabetes practice for an ethno-culturally diverse patient population include: learning more about biological-cultural interactions; gaining experience with lifestyle and behavioral medicine, especially motivational interviewing; creating a safe and immersive clinical environment; incorporating translation services, social prescribing, wearable technologies, web-based resources, and community engagement; and establishing referral networks with clinical trialists in diabetes research to improve recruitment of different populations.

Abbreviations:

A1C = hemoglobin A1c; **AACE** = American Association of Clinical Endocrinologists; **ABCD** = adiposity-based chronic disease; **BMI** = body mass index; **CPA** = clinical practice algorithm; **CPG** = clinical practice guideline; **DBCD** = dysglycemia-based chronic disease; **DPP** = Diabetes Prevention Program; **GWAS** = genome-wide association study; **HCP** = health care professional(s); **IHS** = Indian Health Service; **LDL** = low-density lipoprotein; **MetS** = metabolic syndrome; **T2D** = type 2 diabetes mellitus; **tDNA** = transcultural Diabetes Nutrition Algorithm; **TG** = triglyceride; **WC** = waist circumference

INTRODUCTION

The American Association of Clinical Endocrinologists (AACE) prioritizes the delivery of optimal endocrine care on both domestic and global scales. This imperative is actualized through various educational programs and white paper publications that not only translate basic research but also apply clinical research findings to clinical practice. These programs and publications mainly focus on aggregated information from various population sources, though biased, as they underrepresent many ethnic minorities. Nevertheless, they emphasize the importance of individualization of care, also known as personalized or precision medicine, or differentiated care. Individualized endocrine care comprises the triad of biochemical information (which in the future will also include molecular information: [epi]genetic, [epi]genomic, metabolomics, etc.), environmental factors, and lifestyle components, with each of these three, in some manner, affected by ethnicity and/or culture. Hence, a wealth of knowledge is gleaned from many aspects of human life that need to be curated and then incorporated into AACE white papers. Consequently, ethno-cultural variables emerge as highly valuable and now mandatory considerations.

Diabetes prevalence rates in 2013-2017 by gender (male/female) varied according to ethnicity in the U.S., with 14.9%/15.3% among Native Americans, 12.2%/13.2% among black, non-Hispanics, 12.6%/11.7% among Hispanics, 9.0%/7.3% among Asian Americans, and 8.1%/6.0% among white, non-Hispanics (1). Many biological, environmental, and cultural drivers for these differences exist, and the challenge for precision medicine is to not only identify these drivers and their networked interactions but also devise ways to mitigate their adverse effects. For instance, in the U.S. from 2014 to 2016, food insecurity occurred in 13.0% of the population, with the highest prevalence rates in the States of Mississippi (18.7%) and Alabama (18.1%) (2). In 2016, the prevalence of very low food security was 4.9% for the U.S. but much higher among black, non-Hispanic households (9.7%) and households with incomes <185% of the poverty level (13.3%) (2). How can food insecurity be reduced in the U.S., and can framing the problem in terms of a chronic disease and health care expenditure driver facilitate a solution?

“Culture” is defined as the clustering of nonphysical human attributes (Table 1). Within a specific culture, there can be a unique distribution of races and ethnicities, each characterized by physical and other biological variables. Notwithstanding the reciprocal, overlapping, and confusing relationships between culture, ethnicity, and race, curating information from different component ethnicities, and then regarding them individually and as interacting entities, can lead to a better understanding of how chronic disease manifests in an American culture. “Transculturalization” refers to a formal process of adapting evidence-based information from a source culture to a different culture (3). Transculturalized clinical recommendations are predominantly in the form of clinical

Table 1
Core Set of Transculturalization Factors^a

Alcohol use	Memes
Anthropometric	Personal behaviors
Culinary styles	Physical activity
Dietary supplement use	Politics
Eating patterns	Psychological stress
Endocrine-disrupting compounds	Public advocacy
Environmental pollution	Regulatory agencies
Food sourcing	Religion
Governmental policy	Research methodology
Health care practices	Socio-economic factors
Medical school curricula	Tobacco use
^a Each culture has a unique distribution of races and ethnicities.	

practice guidelines (CPGs), clinical practice algorithms (CPAs), and checklists. There are blurred lines among transculturalization and other related terms in our lexicon, such as “cultural competency,” “cultural consonance,” and “acculturation,” depending on context (see Glossary). Transculturalization has applications in medical education, clinical practice, and clinical research, with questions of implementation and validation becoming more important in the patient-centered care model. Transculturalization is also a relatively new medical field, reflected by the recent geometric increases in relevant PubMed citations (Table 2).

The purpose of this position paper is to assert the AACE position that transculturalization is a necessary part of optimal endocrine care, with a specific attention to diabetes care. Implicit in this purpose is the formal incorporation of sociological and anthropological principles in medicine. In other words, it is critical that physicians understand the underlying cultural factors that affect chronic disease states and their successful management. This approach facilitates effective health messaging for behavioral change on the part of both the patient and health care professional(s) (HCP). The audience for this paper consists of:

- Public health and personalized/precision medicine professionals,
- HCP interested in cultural aspects of care, and
- Clinical endocrinologists and other diabetes specialists, particularly those interested in ways to optimize care through individualization of evidence-based recommendations.

In this AACE position statement, a thorough introduction is presented, since for many, this is a new field of study. Key biological factors that have been influenced by cultural elements are provided. This is followed by results

of a global transcultural Diabetes Nutrition Algorithm (tDNA) program and the 2015 AACE Pan-American Workshop to develop a CPA for Latin America (4). Then, the recent 2017 *Diabetes Care Across America* program is presented, analyzed, and used to generate a set of specific recommendations to optimize precision type 2 diabetes (T2D) care in the U.S. This AACE position paper underwent a lengthy and diligent review and editing process, with input by the American College of Endocrinology Center for Transcultural Endocrinology, AACE Diabetes Disease State Network, AACE Board of Directors, invited community leaders, and panelists participating in the 2017 *Diabetes Care Across America* program.

BIOLOGICAL FACTORS IN DIABETES INFLUENCED BY CULTURE – GENERAL DISCUSSION

The epidemiology of diabetes is complicated when considering ethno-cultural and geographic diversity. For example, the odds ratio for the development of T2D varies across different non-European ethnicities among those living in Europe, relative to individuals of European descent living in Europe: South Asia (3.7), Middle East and North Africa (primarily Arab; 2.7), sub-Saharan Africa (2.6), Western Pacific (2.3), and South and Central American (1.3) (5). Moreover, population admixtures can confound these figures; for instance, 80% of the African American population is from African ancestry and 20% from European ancestry (6).

Biological factors in diabetes pathogenesis and disease expression can be organized according to ethnicity to better define diabetes care in a certain population

Table 2
PubMed Citations in Transcultural Endocrinology Over Time^a

	Transcultural (All languages)	+Diabetes (All languages)	+Obesity (All languages)	+Nutrition (All languages)	Transcultural (non-English)
Years	(% change)	(% change)	(% change)	(% change)	(% change)
<1979	113	0	1	1	39
1979-1983	80	0	0	0	14
1984-1988	87 (+1)	0	1	2	22 (+57)
1989-1993	498 (+472)	5	1 (0)	5 (+150)	117 (+432)
1994-1998	1120 (+125)	10 (+100)	2 (+100)	8 (+38)	126 (+8)
1999-2003	864 (–23)	10 (0)	3 (+50)	5 (–38)	85 (–33)
2004-2008	887 (+3)	24 (+140)	7 (+133)	3 (–40)	98 (+15)
2009-2013	800 (–4)	20 (–20)	13 (+86)	14 (+367)	106 (+8)
2014-2018	943 (+18)	21 (+5)	15 (+15)	25 (+79)	74 (–43)
Total	5,392	90	43	72	681

^aPubMed search using keywords “transcultural” with “diabetes,” “obesity,” or “nutrition,” by specified publication date ranges (performed on December 15, 2018). The initial surge in citations occurred from 1989-1998, with a relatively constant rate of subsequent citations through 2018 (though nutrition-related citations appear to be accelerating).

(Table 3) (7-94). These biological factors include sentinel single nucleotide polymorphisms (SNPs) and DNA methylation (epigenetics) of regulatory pathways that involve insulin resistance, pancreatic β -cell function, obesity and adipocyte function, inflammation, end-organ pathophysiology related to complications, and other processes. Biological factors can be evaluated using trans-ancestry (or trans-ethnic) genome-wide association studies (GWASs), exome chip association studies, replication studies, and other individual genetic ancestry estimates and informative markers (95-99). In fact, these factors, modifiers, and traits can be intertwined in such curious ways to account for subtle differences in disease expression among different ethno-cultural populations. For example, Tekoya-Ayele et al (100) found that certain SNPs associated with metabolic syndrome (MetS) risk implicated physiologic pathways involving brain function and insulin resistance, and Simons et al (101) found that financial pressures in patients with low-income levels were associated with epigenetic measures, or “weathering,” of biological aging. A common-

ality among cardio-metabolic risks is inflammation, and Kocarnik et al (102) found 16 SNP-C-reactive protein (CRP) associations spanning multiple ancestral groups (European American, African American, and Hispanic, but not Asian/Pacific Islander or Native American), with many exhibiting pleiotropic effects. From a practical standpoint, Kaphingst et al (103) found that health literacy and communication skills were critical for patients to understand genomic information and how it affects their disease risk. Moreover, Ostergren et al (104) reported ethno-racial differences in the comprehension of personal genomic testing results.

Shortcomings in statistical analyses of trans-ancestry GWASs can be addressed through dedicated investigation of gene-gene and gene-environment interactions, especially at the network level (105), as well as consideration of genetic drift, population migrations, and natural selection (106). However, in the case of Native Americans, genotype imputation accuracy has been limited due to a relative paucity of reference population data (such as Pima Indians)

Table 3
Biological Factors Relevant to Dysglycemia-Based Chronic Disease Care by Ethnicity^a

Ethnicity	Biological factors	References
Non-Hispanic Caucasian; White and European Americans	• <i>APOC3</i> R19X null mutation cardioprotective in Pennsylvania Amish	7
	• sIL-2R α associated with CVD risk equivalent with EA	8
	• <i>LRPAP1</i> -rs762861 gene variant associated with increased risk for MetS; and <i>KCNJ11</i> gene variant with T2D in Tunisians	9,10
	• Positive linear association of P-selectin with CHD	11
	• <i>CAVI</i> gene variant associated with MetS	12
	• Use of new pregnancy-specific screening criteria for GCK-MODY	13
	• <i>NAT2</i> [rs1208 (803A>G, K268R)] gene variant associated with IR independent of BMI	14
	• Cumulative risk allele load associated with T2D risk in EA but only marginally in AA	15
	• No association of <i>FTO</i> minor allele with weight loss interventions	16
	• Strong association of AA (decreased GLY, increased VAL, LEU, GLA/GLN) with T2D compared with Latinos and AA	17
	• Association of 49 loci with WHR adjusted for BMI and in adipogenesis, angiogenesis, neural, and insulin resistance pathways	18
	• Associations of high maternal BMI and BG with higher offspring birth weight, and association of high maternal sBP with lower offspring birth weight	19
	• 97 gene loci account for about 2.7% BMI variation	20
	• Strongest inverse association of diet quality with T2D risk, compared with other ethnicities	21
African-African; Black	• No effect of African genome origin on BP in Brazil	22
	• GWAS association of novel T2D locus on chromosome 14q with reduced age of disease onset in Gullah-speaking African Americans	137
	• GWAS association of unique loci with body fat distribution and VLDL-c, LDL-c, and LDL particle size in Gullah-speaking African Americans	138-140
	• <i>UCP3</i> allelic variant, with a 10% frequency, associated with increased risk of severe obesity in Gullah-speaking African Americans and in ancestral Sierra Leone tribes	141

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Table 3 Continued		
(non-Hispanic)	• Adiponectin directly associated with HTN and inversely associated with T2D in AA women (not men)	23
	• Association of <i>APOE-12</i> rs7214 with higher CRP in AA	24
	• QRS-prolonging rs3922844 C allele associated with decreased atrial <i>SCN5A</i> gene expression in AA	25
	• Epigenetic weathering of aging in low-income AA women	26
	• rs73989312[A] SNP near <i>CA10</i> confers risk and rs77244975[C] SNP in <i>CTNNA3</i> confers protection for MetS in a Ghana, Nigeria, and Kenya population	27
	• <i>BCAA</i> not associated with incident T2D	28
	• Gene variants with SNP associated with increased T2D risk (<i>TCF7L2</i> , <i>KCNQ1</i> , <i>HMGA2</i> , <i>HLA-B</i> , <i>INS-IGF2</i>)	29
	• Association of <i>ADIPOQ</i> SNP with T2D	30
	• Increased obesity, insulin resistance, and T2D with migration to Europe among Ghanaians	31
	• Association of <i>ATP5SL</i> with T2D and <i>MCC1</i> with BMI	32
	• Subclinical atherosclerosis associated with decreased GMV and cognitive function in T2D	33
	• Association of <i>PPARA</i> , <i>CDKAL1</i> , and <i>NEGR1</i> gene variants with energy metabolism and T2D/obesity risk in Ethiopians	34
	• Association of <i>ACSL1</i> rs4862423 gene variant with CAC scores (subclinical atherosclerosis)	35
	• Cumulative risk allele load only marginally associated with the increase T2D risk	15
	• Association of <i>CXCL12</i> gene variant (affects insulin sensitivity) with SNP involved with insulin secretion	36
	• Lower levels of sRAGE, but this is unrelated to causal rs2070600 <i>AGER</i> gene variant or CHD risk	37
	• Associations of <i>SAMD4A</i> (rs11627203) and <i>UTRN</i> (rs17074194) gene variants with AIR _g and GRS	38
	• Multiple gene variants associating SFU with adverse EKG phenotypes	39
	• Pericardial adipose tissue associated with CAC	40
	• <i>AKT2</i> p.Pro50Thr gene variant (association with increased fasting insulin) absent in AA	41
	• rs1050828 <i>G6PD</i> variant and decreased A1C	42
	• rs116550874, rs3792874 & leisure-time physical activity	43
	• Decreased brain <i>ABC1</i> gene expression with ↑BMI	44
	• Combined <i>FG23</i> and <i>APOL1</i> with ↑mortality	45
	• F ₂ -isoprostane levels inversely associated with T2D/weight	46
	• Hepatocyte growth factor and ↑CHD risk	47
	• High aldosterone and renin with CVD risk and mortality	48
	• Free vitamin D positive association with insulin sensitivity	49
	• Renal impairment in T2D associated with dysfunction	50
	• No association of <i>FTO</i> -rs9939609 minor allele with BMI	16
	• <i>CMIP</i> intronic SNIP rs17197883 associated with acute insulin response to glucose and T2D susceptibility gene variant	51

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Table 3 Continued		
Latino/ Hispanic	• <i>PHF14</i> , <i>MAP4</i> , and <i>SNUPN</i> gene variants associated with HTN in Mexican-Americans	52
	• Gene variants in 3p26 region associated with uric acid levels and CVD risk in Mexican-Americans	53
	• Association of <i>NFIB</i> and <i>LAMA1</i> genes with insulin resistance in Latino Americans	54
	• Amerindian-specific variant rs117672662 in the <i>ACTN1</i> gene associated with platelet function in Latin Americans	55
	• <i>CAVI</i> gene variant associated with MetS	56
	• Association of <i>UNC5C</i> and <i>APOA5</i> gene variants with sq AT volume and TG, respectively	57
	• Cell cycle and tight junction gene networks with CVD/T2D in Latino women (key drivers are <i>COL1A1</i> , <i>COL3A1</i> , and <i>ELN</i>)	58
	• Adiponectin independently associated with DR and IR	59
	• <i>SLC35B3/TFAP2A</i> , <i>CDKAL1</i> , and <i>MRNR1B</i> gene variants associated with insulin action and T2D	60
	• DNA methylation at 5 CpG sites of 3 genes (<i>TXNIP</i> , <i>ABCG1</i> and <i>SAMD12</i>) associated with T2D risk	61
	• Lack of association of high cotinine (major nicotine metabolite) with decreased insulin secretion	62
	• Association of <i>ADH1B</i> gene with obesity and insulin resistance	63
	• Association of missense SNP in <i>ZGRF1</i> and intronic SNP in <i>IDH1</i> with adiposity measures	64
	• Free vitamin D positive association with insulin sensitivity	49
Asian Indian	• Merits of non-classical CAD risk factors (FH, AIP)	65
	• <i>TMEM163</i> associated with T2D and encoding a vesicular transported in nerve terminals	66
	• <i>INS</i> , <i>INSR</i> , <i>PP1G.G</i> gene variants confer T2D risk in 3 North-West India ethnicities	67
	• Association of <i>CAPN10</i> gene variant with T2D	68
	• Association of rs5435 (<i>C/T</i>) <i>GLUT4</i> polymorphism with T2D in south Indians	69
	• No association of Gly972Arg and Ala513Pro <i>IRS1</i> gene variants with T2D in south Indians	70
	• High methylation scores associated with T2D for (<i>ABCG1</i> , <i>PHOSPHO1</i> , <i>SOCS3</i> , <i>SREBF1</i> , and <i>TXNIP</i>)	71
	• rs3812704 upstream of <i>NEUROG3</i> (BMI independent) and <i>HNF4A</i> promoter rs1884613 and rs2144908 P2 polymorphisms associated with β -cells and T2D	72
Southeast/East Asian	• Pleiotropic effects of region 12q24.12 on FPG, BP, and adiposity in Koreans	73
	• 9 gene variants associated with A1C variance (<i>TMEM79</i> , <i>HBS1L/MYB</i> , <i>MYO9B</i> , <i>CYBA</i> , <i>CDKAL1</i> , <i>G6PC2/ABCB11</i> , <i>GCK</i> , <i>ANK1</i> , and <i>FN3K1</i>)	74
	• Association of gene variants (<i>ABCC8</i> , <i>CDKAL1</i> , <i>CDKN2A</i> , <i>HNF1B</i> , <i>KCNJ11</i> , and <i>MTNR1B</i>) with gestational insulin signaling in Chinese women	75
	• Increased risk frequency for <i>TMEM163</i> rs6723108 gene variant in Chinese Mongolian T2D population	76
	• Positive association of <i>FTO</i> and fat intake with BMI	16
	• Association of <i>EFEMP1</i> , <i>ADAMTSL3</i> , <i>CNPY2</i> , <i>GNAS</i> with BMI-adjusted WC and WHR and with functional enrichment with CRF, GnRH, and CDK5 signaling pathways	77
	• Association of the rs1801282 (<i>PPAR</i>) α gene variant and thiazolidinedione targets in Japanese patients with T2D	78
	• Association of the rs5215 <i>KCNJ11/ABCC8/KCNJ8</i> gene variants and sulfonylurea/glinide targets in Japanese patients with T2D	78

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Table 3 Continued		
Native American	• Association of SNPs with glucose/insulin levels (rs4607517/ <i>GCKR</i> , rs780094/ <i>GCKR</i>)	79
	• No association of common <i>ACDC</i> adiponectin gene polymorphisms with T2D in Pima Indians	80
	• No association of <i>PPP1R2</i> gene mutations with insulin resistance in Pima Indians	81
	• Native American ancestry in Latinos associated with increased risk for severe retinopathy	82
	• <i>AKR1B1</i> common mutations are not major determinants of CKD	83
	• Lack of inverse relationship between coffee consumption and total mortality in native Hawaiians	84
	• <i>GPR158</i> rs11014566 G-allele in Pima people is associated with reduced energy expenditure	85
	• Melanocortin-4 receptor rs74861148 and rs483125 gene variants are associated with BMI in Pima people	86
	• <i>SLC16A11</i> rs75493593 A allele associated with nearby <i>RNASEK</i> gene expression and nominally associated with T2D, particularly in lean Native Americans	87
	• <i>DNER</i> rs1861612 T allele associated with T2D risk in Pima people by regulating expression of the notch signaling pathway in β -cells	88
Arab, Middle-East North Africa, Persian Gulf	• One epigenetic (CpG) association with T2D (<i>TXNIP</i>) and seven with BMI (<i>SOCS3</i> , <i>SREBF1</i> , <i>SBNO2</i> , <i>CPT1A</i> , <i>PRR5L</i>) intergenic region on chromosome 17, and <i>LY6G6E</i> by replication; one EWAS CpG association <i>DQX1</i> and T2D	89
	• Association of a CNVR in <i>AKNAD1</i> gene with T2D in Jordanians	90
	• Polymorphisms in <i>TCF7L2</i> rs10885409 C allele are risk factors for T2D and modulated by obesity in Emirati population	91
	• <i>PPAR-γ2</i> Pro12Ala mutation not associated with T2D risk in Emirati population	91
	• Association between vitamin D receptor gene SNPs and T2D in Emirati population	92
	• Significant correlation between <i>C282Y</i> and <i>H63D</i> mutations and development of CAD in Iranians with T2D	93
	• Angiotensin converting enzyme I allele is associated with T2D but not CVD in Arab population	94
Abbreviations: AA = African American; AIP = atherogenic index of plasma; AIR _g = acute insulin response to glucose; BG = blood glucose; BP = blood pressure; BMI = body mass index; CAC = coronary artery calcium; CAD = coronary artery disease; CHD = coronary heart disease; CNVR = copy number variable region; CRP = C-reactive protein; CVD = cardiovascular disease; DBCD = dysglycemia-based chronic disease; DR = diabetic retinopathy; EA = European American; FH = family history; FPG = fasting plasma glucose; GCK-MODY = glucokinase maturity onset diabetes of the young; GMV = gray matter volume; GRS = genetic risk score; GWAS = genome-wide association study; HTN = hypertension; IR = insulin resistance; LDL-c = low-density-lipoprotein cholesterol; MetS = metabolic syndrome; SFU = sulfonylurea; sRAGE = soluble receptor for advance glycation end-products; T2D = type 2 diabetes; VLDL-c = very-low-density-lipoprotein cholesterol; WHR = waist to hip ratio. ^a Comprehensive DBCD care includes cardio-metabolic variables. Biological factors pertain to entire ethnicity unless otherwise specified.		

(107). The principal benefit of this type of biological information could be more precise therapeutic targeting, including lifestyle interventions and specific pharmaceuticals.

Biological factors are not the only primary determinant of T2D risk or natural history. Keaton et al (108) showed that even though African-descent populations have a greater risk for T2D than European-descent populations, the cumulative risk allele load was not associated with T2D risk in people of African descent but was associated in people of European descent. This discrepant finding suggests not only the existence of varying ethnic-specific genetic architectures, as well as the role of epigenomic pressures, but also a broad-spectrum of environmental and cultural factors that will require scientific clarification. In other words, optimal T2D management requires contextualization but awaits further clinical investigation (Table 4) (109).

Major cities in the U.S. have significant degrees of racial, ethnic, and lifestyle diversity (Table 5), which define multicultural populations and characterize the overall diverse American culture. This means that there are distinctive transcultural challenges in T2D care that are linked with the varying demographics among U.S. cities, and these challenges can be specifically addressed through formal transcultural adaptations of published CPG and CPA. This paper is a next step in this formal process.

SUMMARY OF FINDINGS FROM THE TRANSCULTURAL DIABETES NUTRITION ALGORITHM PROGRAM

The results of novel international summits from 2010 to 2013 (110-117), led by U.S. tDNA committee members and local thought leaders, were curated and then incorpo-

Table 4
Checklist of Contextualization Factors^a

1. Physical: Built Environment
 - a. Healthy food supply/availability (stores, restaurants, schools, workplace)
 - b. Fitness resources (walking/running paths, gyms, school programs, parks)
 - c. Building design (stairs, elevators, walking distances, handicapped access)
 - d. Safety (surveillance, transportation, city/community design, energy supply)
 - e. Pollution (water supply, endocrine disruptors, air, food chain)

1. Nonphysical: Transcultural
 - a. Ethnicity (cluster of physical and nonphysical human factors)
 - b. Belief structures, behaviors, customs, and attitudes (toward food, physical activity, HCP)
 - c. Social factors (screen time, family structure, appearance in public)
 - d. Economic factors (affordability of healthy and dependence on unhealthy lifestyle components)
 - e. Political factors
 - f. Religious factors
 - g. Education levels
 - h. Stress (crime, economic, personal; at work, at school, at home; sleep hygiene, comfort foods; food security)
 - i. Disparities, discrimination, stigmatization (age, gender, race/ethnicity, economic class)

Abbreviation: HCP = health care professional(s).

^aThe built environment general refers to “human-made” elements, but these are influenced by natural factors, such as geography and climate. Adapted from *Endocr Pract.* 2017;23:372-378 (109).

Table 5
Race and Ethnicity Percentages in Populous U.S. Cities^a

City	Population	Non- Hispanic White	Latino	Black and African American	Asian	Native American
New York	8,175,133	33.3	28.6	25.5	12.7	0.7
Los Angeles	3,792,621	29.4	47.5	9.8	10.7	0.5
Chicago	2,695,598	45.0	28.9	32.9	5.5	0.5
Houston	2,099,451	25.6	43.8	25.2	6.0	0.7
Philadelphia	1,526,006	45.3	13.6	44.1	7.2	0.8
Phoenix	1,445,632	46.5	40.8	6.5	3.2	2.6
San Antonio	1,327,407	26.6	63.2	6.9	2.4	0.1
San Diego	1,307,402	45.1	28.8	6.7	15.9	0.6
Dallas	1,197,816	28.8	42.4	25.0	2.9	0.5
San Jose	945,942	28.7	33.2	3.2	32.0	0.9
Miami	463,347	11.2	71.2	18.8	0.9	0.2

^aCities in bold font were settings for the AACE 3-city “Diabetes Care Across America” summits. Total percentages for a city may be <100% since other race/ethnicities are not represented or >100% if there are significant overlaps among groups. Data extracted from <http://www.s4.brown.edu/us2010/segregation2010/city.aspx?cityid=4835000>, <http://www.census.gov/quickfacts/table/SEX205210/3651000>, <http://www.census.gov/2010census/popmap/>, <http://www.nlc.org/build-skills-and-networks/resources/cities-101/city-factoids/the-30-most-populous-cities> (accessed January 28, 2017).

rated into a tangible toolkit with multiple formats to facilitate local HCP-patient encounters (118). Content validation by diabetes specialists and primary care HCP was reported in 2014 (118). Multiple clinical validation studies are in progress, with the first reported for patients with diabetes in Malaysia in 2017 (119). In this study, those exposed to counseling assisted by the tDNA toolkit (brochures, flipcharts, and other physical educational aids) had greater improvements in weight (body mass index; BMI) and glycemic control (hemoglobin A1c; A1C) than those without toolkit assistance, and moreover, those patients exposed to the toolkit had greater improvements when motivational interviewing techniques were used, compared with conventional counseling (119). The aggregated findings of the tDNA program have been reviewed elsewhere (120,121).

SUMMARY OF FINDINGS FROM THE 2015 AACE PAN-AMERICAN WORKSHOP

In 2015 in San Jose, Costa Rica, AACE convened a workshop involving 14 expert clinical endocrinologists from 9 Latin American countries to culturally adapt an AACE CPA on glycemic control in patients with T2D; results were published in both English and Spanish (4). The tDNA transculturalization method was adapted for this conference and based on a consensus AACE CPA template (Fig. 1) and node-level clinical recommendations (Fig. 2). Key principles related to T2D for Latin America that can be used to guide transculturalization in the U.S. were:

1. **There is only one level of optimal endocrine care for patients:** the participants rejected the notion that there should be separate private and public levels of care for high and low socio-economic classes, respectively.

Realistically, the one target level of care was viewed as “excellent,” but within the context of feasibility and need for transformation at a systems level.

2. **All patients with suspected prediabetes or diabetes should have an A1C measurement as part of the initial evaluation and, if the diagnosis is confirmed, have A1C measurements during follow-up to assess response to a therapeutic plan:** the participants recognized that there are problems with accessibility and affordability of a reliable A1C assay but agreed that this test was a necessary part of an optimal diabetes care plan and systems infrastructure would need to be changed.
3. **Nutritional education and pharmacologic options are necessary to optimize the obesity care model:** the participants recognized the important relationships among obesity, insulin resistance, and T2D, and that inertia in creating a successful comprehensive obesity care model was due to a conspicuous lack of effective nutritional education and pharmacologic options.

“DIABETES CARE ACROSS AMERICA – A SERIES OF TRANSCULTURAL SUMMITS”

Strategy

In December 2017, AACE organized conferences/summits in three American cities with culturally diverse populations: New York, Houston, and Miami (Table 5). The purpose of this program was to apply the methodologies and findings from the previously reported global transcultural diabetes nutrition (tDNA) initiative and the AACE Pan-America Workshop to the domestic setting. Specifically, the research question was “How can the care of patients with T2D in America be optimized by

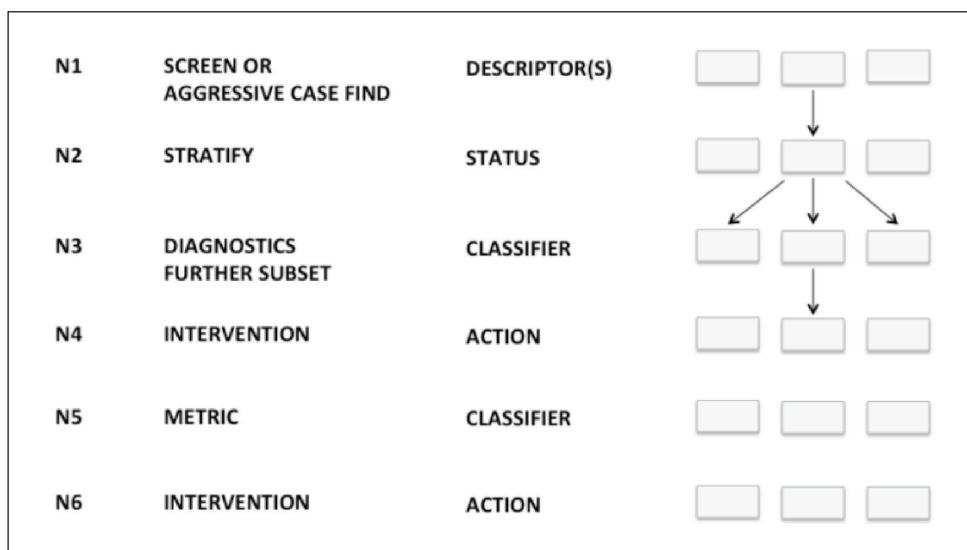


Fig. 1. American Association of Clinical Endocrinologists clinical practice algorithm template for transculturalization. *Reprinted with permission from *Endocr Pract.* 2016;22:476-501 (4).

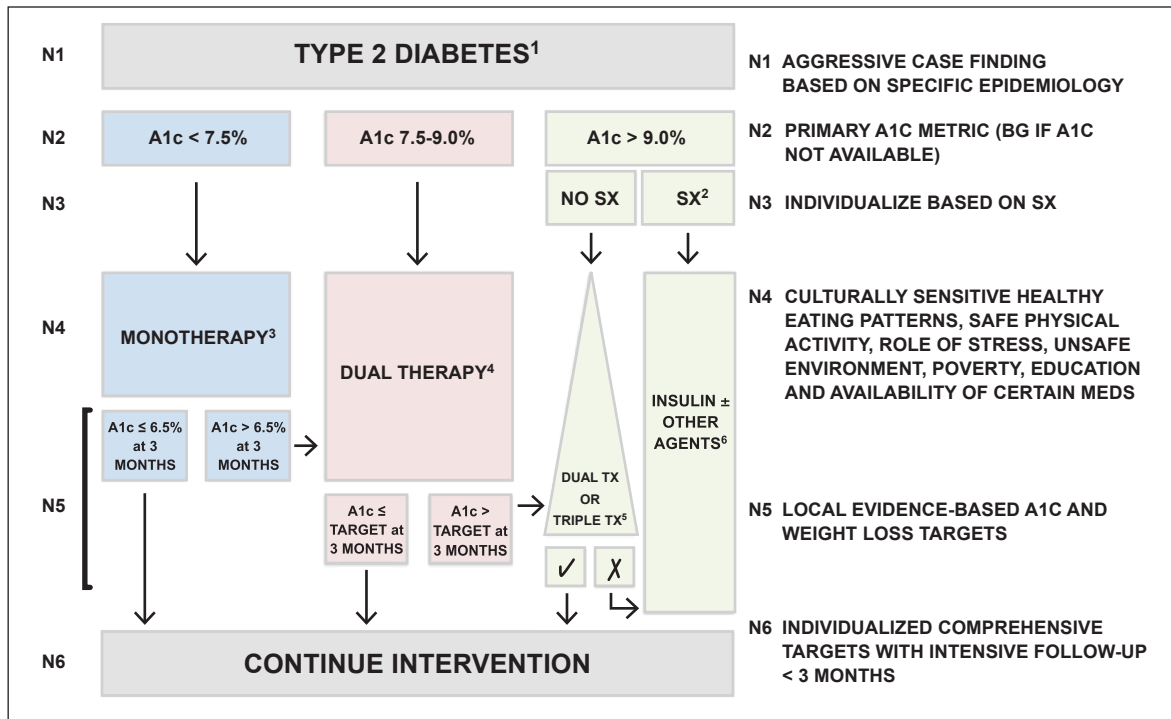


Fig. 2. American Association of Clinical Endocrinologists type 2 diabetes clinical practice algorithm template for glycemic control in Latin America.* Abbreviations: A1C = hemoglobin A1c; BG = blood glucose; SX = symptoms; TX = treatment. *Adapted with permission from *Endocr Pract.* 2016;22:476-501 (4).

taking into account cultural factors?” The need and premise for this domestic program in the U.S. were based on the following:

1. High prevalence rates of T2D and obesity impart significant adverse impact on disability and quality of life;
2. Current evidence-based recommendations are primarily based on aggregated data representing a Caucasian/Europid/white majority (terminology is confounded by different data sources);
3. Growing cultural diversity in America, particularly in large American cities, negatively impacts the precision of T2D care; and
4. Existing knowledge from the tDNA project can guide a domestic program addressing cultural diversity among patients with T2D.

The mission of the program was to provide a core set of recommendations for endocrinologists and other HCP that can optimize diabetes management by improving:

1. Recognition of ethno-cultural variables among African American, Latino/Hispanic, Asian American, and Native American populations in the U.S. with T2D, relevant to published CPG/CPA from aggregated data;
2. Implementation of specific strategies that address these variables and improve precision of T2D care; and
3. Formulation of social systems changes regarding awareness, communication and health messaging, adherence, resource availability, and economic feasi-

bility to improve clinical outcomes for all patients with T2D.

The vision of the program was to compile important information from thought leaders, to then enable transculturalization of white papers on diabetes care in the U.S.

Tactic

The structures of the “Diabetes Care Across America” conferences were similar, and the actions taken consisted of:

1. Preconference questionnaires, distribution of reading materials, and determination of specific areas of consensus and disagreement;
2. Community leader forum to generate key challenges and discussion points for the moderator;
3. Formal conference with community leaders, HCP, and diabetes care thought leaders to generate information that focused on four specific American cultures: African American, Latino/Hispanic, Asian American, and Native American; and
4. Organization and analysis of information, synthesis of ideas, and then derivation of recommendations for an AACE Position Statement that are easily understandable, relevant, and actionable for diabetes care across different U.S. cultures, ethnicities, and populations.

Results

Evidence-based recommendations for the general American population with diabetes are provided by AACE CPG/CPA (122,123) and confer the greatest relevance to

the aggregated U.S. population since they are derived from clinical trials evidence based on a majority of Caucasian patients. For instance, among the major cardiovascular outcome trials, 67 to 83% of participants were Caucasians, compared with only 1 to 7% American Islanders/Alaska Natives/others, 3 to 8% African Americans, 7 to 21% Latino/Hispanics, and 9 to 22% Asians (Table 6) (124-133). Conference participants recognized that it was difficult and beyond the scope of the meeting to provide highly granular information, well beyond the four broad ethnic minority populations described above. Results provided here take the form of scientific evidence and recommendations that were presented at the Summits, discussed, and ultimately deemed relevant to culturally competent diabetes care in America.

A prominent and yet controversial issue was terminology, and more specifically, the use of certain words and demographic classifiers with negative or unpleasant connotations. Generally speaking, a patient's race and ethnicity should be self-reported and not assigned. In addition, the use of the term "subpopulation" indicated dominance of one population over another and was dissuaded. Alternatively, the term "copopulation," or more simply "population," was encouraged in the context of multiculturalism, where cultural diversity within a population is recognized and applauded.

African American

Demographics and Biology

In a genome-wide study of African Americans by Zakharia et al (134), an admixture of 73.2 to 82.1% West African, 16.7 to 24.0% European, and 0.8 to 1.2% Native American ancestry was demonstrated. In a model of T2D for African Americans, Chatterjee et al (135) schematically traced how genetic susceptibility, intrauterine and various environment factors interacted and then

affected pancreatic β -cell function, insulin resistance, and adiposity/obesity to fashion disease expression. Ng et al (29) found several gene variants associated with T2D or fasting insulin levels in African ancestry populations: *RND3-RBM43* (rs7560163), *TCF7L2* (rs7903146), *KCNQ1* (rs231356 and rs2283228), *HMGA2* (rs343092), *HLA-B* (rs2244020), *INS-IGF2* (rs3842770), *SC4MOL* (rs17046216), and *TCERGIL* (rs7077836). Additionally, in a genome-wide analysis using imputed data from the Women's Health Initiative, Jackson Heart Study, and Framingham Heart Study, Lin et al (43) found two gene variants (rs116550874 and rs3792874; affecting homeostasis, neural reward system, and constraints on capacity) that were associated with leisure-time physical activity in African Americans.

In another scenario, Gullah-speaking African Americans living in the South Carolina low country have the lowest degree of European admixture of any group of African Americans (136). In this population, a GWAS (Project SuGAR) identified a novel T2D locus on chromosome 14q that is associated with a later age of diagnosis (137), and unique loci influencing body fat distribution (138) and very-low-density-lipoprotein cholesterol, low-density lipoprotein (LDL) cholesterol, and LDL particle size (139,140). Other studies identified an allelic variant of uncoupling protein-3, with an allele frequency of 10% in both Gullah-speaking African Americans and in ancestral Sierra Leone tribes (141). This variant confers increased risk of severe obesity by favoring storage of dietary fat due to a metabolic preference for carbohydrates in generating resting energy expenditure (141). Of note, the emerging field of health disparities in genetic and genomic research, particularly championed by nurse scientists, has been detailed by Spruill et al (142).

Many important biological correlates result from specific gene variants found in African Americans. For instance, the presence of sickle cell trait affects A1C levels,

Table 6
Ethnic Minority Representation in Cardiovascular Outcome Trials^a

Study (Reference)	Agent	Caucasian	American Islander, Alaska Native, Other	African American	Latino/Hispanic	Asian
Tecos (124)	Sitagliptin	67.9	6.8	3	12	22
Examine (125)	Alogliptin	72	2.1	4	NR	20
Savor-Timi-53 (126,127)	Saxagliptin	75	NR	3.4-8.5	21.5	NR
Leader (128)	Liraglutide	77	4.1	8.3	12	10
Sustain (129)	Semaglutide	83	2	6.7	15	8.3
Exscele (130)	Exenatide	75	0.7	6	7.8	9
Canvas (131)	Canagliflozin	78	5.7	3.3	NR	12.7
Empa-Reg (132)	Empagliflozin	72	1	5.1	18	21.4
Declare TIMI 58 (133)	Dapagliflozin	79.6	3.5	3.5	15	13.4

Abbreviation: NR = not reported.

^aData presented as percentages.

where the risk for T2D is underestimated based on fasting and 2-hour postchallenge glucose levels (143). Also, there is decreased hepatic > extrahepatic insulin degradation in African Americans, compared with non-Hispanic whites (144). From a pragmatic standpoint and using the SUPREME-DM network, Karter et al (145) found that African American patients with diabetes had higher rates of hypoglycemia with secretagogue or insulin therapy, compared with Caucasians, Latino/Hispanics, Asians, and the total study population. Interestingly, even though A1C levels are higher among healthy (normoglycemic) African American offspring of parents with T2D, compared with their Caucasian counterparts (146), the conversion rates of prediabetes to T2D (about 11% per year) for these two races were comparable (147). Using data from the Jackson Heart Study (N = 5,301), Casanova et al (148) developed a high-dimensional machine learning tool to predict incident diabetes among African Americans, based on the following variables: A1C, fasting plasma glucose, waist circumference (WC), adiponectin, BMI, high-sensitivity C-reactive protein (hsCRP), triglycerides (TGs), age, leptin, body surface area, estimated glomerular filtration rate (eGFR), 2D calculated left ventricular mass, fasting high-density lipoprotein (HDL) and LDL cholesterol levels, and aldosterone. In a simpler predictive model, five modifiable lifestyle risk factors were associated with incident diabetes (more predictive with BMI <30 kg/m²): tobacco smoking, television watching, physical activity, healthy eating, and sleep hygiene (149). Additional associations between biological factors and traits are provided in Table 3.

As with each of the populations examined in this program, terminology is imprecise but important. Even though the term African American is used in this position statement, it excludes black Americans of Caribbean or non-African descent. A sensitive issue is that the descriptor “descended from slaves” should be avoided. Alternatively, the term “descended from those who were enslaved” is more appropriate. However, since some African Americans are descended from those never enslaved, the term “of the African Diaspora” may also be considered.

Behavior and Social Determinants

The complex legacy of slavery in American history contributes to the often unspoken sentiment of many African Americans of distrust for their non-African American doctors. Lack of trust is a consistent driver in discussions of diabetes care for African Americans (150). In a qualitative study using semistructured focus groups, Shiyabola et al (151) affirmed the relationship between T2D management and socio-cultural context. Specifically, members of the African American community have perceptions of the world—including T2D care—that are based on historical circumstances, such as slavery and poverty effects, and current experiences, such as racial minority and trust effects (151).

Barriers to clinical research recruitment and participation among African Americans not only includes trust issues but also the misperception of “experimentation,” inadequate communication, and overly complicated logistics (152). A poor representation of African Americans in clinical trials for diabetes translates into biased and imprecise conclusions, particularly in terms of clinical recommendations for African Americans with diabetes (Table 6). Potential solutions to this problem have been proposed and implemented by Spruill et al (153), incorporating local citizen advisory committees, as well as community-based reward systems involving services, benefits, and incentives.

The African American culture includes certain hair-styles, fashion, dance, music, visual art, worldview, inner city neighborhoods, attendance at church, as well as eating patterns. Traditional African American cuisine has historical roots and is generally high in saturated fat, sodium, and starch (154,155). This eating pattern can consist of cooking leftovers into a mixture with a consistency between stew and soup, sharing of food, particularly in community settings, cultivation and use of yams, peanuts, rice, okra, sorghum, grits, and incorporation of chicken, fish, macaroni and cheese, cornbread, black-eyed peas, and rice (e.g., Hoppin’ John: black-eyed or other peas, rice, chopped onion, salt, pepper, herbs/spices, and bacon, ham hock, fatback, country sausage, or smoked turkey).

According to the U.S. Census Bureau, the percentage of African Americans in 2017 was 13.4% (156). According to the 2010 U.S. Census data, the greatest percentage of African Americans resides in metropolitan areas, primarily in the southeast region of the U.S. (157). In aggregate, African Americans are in a low socio-economic stratum by homeownership and income level (158,159). However, within the African American community there is significant socioeconomic diversity, well represented by the growing black upper middle class in America, termed the “Black Elite,” from the 1955 (French) and 1957 (English) historical reference “Black Bourgeoisie” by E. Franklin Frazier (160).

Poverty is a critical deterrent to good health, and the manifold impact of poverty on health and health care service lines needs to be recognized, understood, and factored into clinical decision-making by HCP. Poverty is associated with fatalism, dependency, need for governmental aid, drug and alcohol use, stresses on family life, low self-esteem, community disengagement, increased risk for disease and complications, and decreased access to quality health care, but also gaps in formal population-specific recommendations (4,161). Moreover, there are environmental inequalities or disparities in exposure to endocrine-disrupting compounds (endocrine disrupting chemicals or EDCs; polychlorinated biphenyls, organochlorine pesticides, air pollutants, bisphenol A, and phthalates) (162). This socio-economic correlate involving EDCs affects diabetes prevalence rates (162).

Discrimination also affects rates of incident T2D according to the Multi-Ethnic Study of Atherosclerosis (163). There was a 34 to 40% increased risk for T2D with ≥ 2 discrimination events among various ethnicities (163). Watson et al (164) found that racial contextualization affects public perceptions of Black Caribbeans and influences African American acculturation.

Diabetes Care

Among African Americans, the overall prevalence of diabetes is relatively high (12.2% in men and 13.2% in women), which correlates with a similarly high prevalence of obesity (33.8% in men and 44.2% in women) (1,165). Among African Americans, there are disproportionately high morbidity and mortality rates, lower quality and accessibility of health care, less representative randomized controlled study data, more atypical and ketosis-prone diabetes, and more associated MetS, compared with the general American population (166). Adverse perceptions of insulin among African Americans with uncontrolled T2D also impact care and are based on fears, fatalism, self-blame, stigma, frustration, mindset, self-care fatigue, and miscommunications among family, friends, co-workers, and HCP (167). “Self-concept” as an African American with diabetes is an important determinant for medication adherence and comprises two types of interacting experiences: “adaptive” (confidence in controlling the disease, belief in the value of medication, assuming responsibility for one’s health, developing a routine for taking medicine, and positive relationships with the care team) and “ineffective” (feeling powerless in controlling the disease, self-blame, and fear) (168). By addressing and openly discussing these behavioral factors, diabetes care can be improved.

In current AACE chronic care models for adiposity-based chronic disease (ABCD) and dysglycemia-based chronic disease (DBCD), one of the first steps in management is behavioral, specifically motivating the patient, or creating a state of “activation for change” (109,169). This motivation occurs through experiential (consciousness awareness, self-reevaluation, dramatic relief, environmental reevaluation, and social liberation) and behavioral (self-liberation or choosing, counter-conditioning, stimulus control, reinforcement management, and helping relationships) processes and may take advantage of written materials, video, and educational tools from professional medical societies (170). Improved adherence is a critical byproduct of behavioral change. Adherence with medications, diet, foot care, self-monitoring of blood glucose (SMBG), and physical activity in African Americans with T2D can be significantly improved with culturally targeted self-management programs in the community (e.g., providing education, stress management, and coping skills in urban church settings) (171). Another technique is to understand culturally specific coping strategies for diabetes self-management among African Americans, particularly

“acknowledgement” (subtheme: “front-seat driver”) and “denial” (subtheme: “back-seat driver”) as part of an active or passive relationship with God (172). In another study, culturally sensitive cognitive interviewing techniques, are useful engagement tools for African American women with T2D; these tools include concurrent and retrospective think-aloud when answering questions, repeating and paraphrasing questions, and follow-up probing questions (173). A larger-scale model for the delivery of health care services for African Americans, based on the transtheoretical model of behavioral change and social learning theory, was reported by Campinha-Bacote (174) and emphasized cultural competency and consisted of cultural awareness, desire, skill, encounters, and knowledge.

In 2017, the American Heart Association published a scientific statement on cardiovascular health in African Americans, based on relatively higher risks for atherosclerotic heart disease, hypertension, stroke, heart failure, and peripheral artery disease, to leverage strengths in the cultural environment: church activities, particularly for women and older adults; policy changes, particularly addressing tobacco use and healthy food availability in schools; and overall, to foster positive health behaviors (175). Taken together and due to more aggressive disease expression, challenges stemming from poverty and community and health care disengagement, diabetes care for African Americans should include more effective use of case managers, bilingual care coordinators (where appropriate), structured disease management, church- (or faith-) based initiatives, and neighborhood center programs (166).

Latino/Hispanic

Demographics and Biology

The term “Latino” refers to those with ancestry in Latin America (e.g., includes Brazil but not Spain), whereas “Hispanic” (a U.S. Census Bureau term) refers to those who are primarily Spanish speaking (e.g., excludes Brazil but includes Spain). “Hispanic” is an ethnic term and not a racial classification. The U.S. Latino/Hispanic population is large and growing, predicted to expand from 17.6% of the total U.S. population in 2015 to 24% by 2065 (176). According to the U.S. Census Bureau, among Latino/Hispanics in the U.S., 63% are Mexican, 9.2% Puerto Rican, 3.5% Cuban, and 24% from the rest of Latin America and Spain (177). According to a study by Hanis et al (178), the Latino/Hispanic genome results from an admixture of different ancestries: Mexican American (31% Native American, 8% African, and 61% Spanish), Puerto Rican (19, 37, and 45%, respectively), and Cuban American (19, 20, and 62%, respectively).

A Latino/Hispanic ethnicity should not be assumed when encountering a patient for the first time based on Spanish surnames or “looking Latin.” There are Latino/

Hispanics that do not speak Spanish and many people from other ethnicities (e.g., Philippines and India) may have Latino/Hispanic sounding names. Latino/Hispanics expect you to shake hands or at least pat them on the back during an encounter. Proper eye contact is valued, in contrast to looking away or focusing on the computer screen during an encounter. If you do not speak any Spanish, you should prepare for the encounter by learning some basic Spanish words (and if necessary to have a translator present).

According to the Centers for Disease Control, in 2017, the prevalence of diabetes among Latino/Hispanics in the U.S. was 12.6% for men and 11.7% for women (1). When broken down further by ethnicity, the prevalence rates for diabetes in the U.S. were 13.8% for Mexicans, 12.0% for Puerto Ricans, 9.0% for Cubans, and 8.5% for Central and South Americans (1). According to the U.S. Department of Health and Human Services 2014, the prevalence rates for prediabetes in Latino/Hispanics in the U.S. were 33.0% for men and 23.7% for women for ages 18 to 44 years, 46.9 and 44.7% for ages 45 to 64 years, and 40.7 and 42.4% for ages 65 to 74 years (179). When further broken down by ethnicity, the prevalence rates for prediabetes in the U.S. were 37.7% for Mexicans, 37.0% for Cubans, 36.3% for South Americans, 36.1% for Central Americans, 34.4% for Puerto Ricans, and 32.1% for Dominicans (179).

Obesity is a major driver for DBCD, and according to 2006-2008 data, it is present in 28.7% of Hispanics, midway between 35.7% for non-Hispanic blacks and 23.7% for non-Hispanic whites (180). However, the insulin sensitivity index is lowest for Latino/Hispanics, compared with Asian Americans, African Americans, and non-Latino whites (181). In the current AACE framework, ABCD independently addresses adiposity in terms of total amount, distribution, and secretory function (109). Among Mexican Americans, abdominal obesity was highest in those born in the U.S. and Spanish speaking, followed by those born in the U.S. but English speaking, and lowest in those born in Mexico (182). In addition, the prevalence of nonalcoholic fatty liver disease is disproportionately high among Latino/Hispanics in the U.S., with potential risk factors not only being genetic, but also MetS, T2D, obesity, hypertension, low LDL, and high TGs (183).

Dietary habits are another major driver for T2D pathogenesis among Latino/Hispanics. Food preferences of Latino/Hispanics in the U.S. include high-fat meats, fats and lards for cooking and food preparation, fried foods, inadequate portion control, and high-glycemic-index items, but also high-fiber items (e.g., corn and beans) (184). Physical inactivity is more prevalent among Latino/Hispanics (foreign born > U.S. born) than Caucasians in the U.S. (185).

Diabetes complications rates are relatively higher for Latino/Hispanics compared with non-Hispanic whites, including nephropathy, retinopathy, and lower-extremity

amputations (186-191). Using 1997-2011 data, mortality rates due to diabetes in Latino/Hispanics (7.0% as underlying cause; 15.7% as contributing cause) are higher than in non-Hispanic blacks (5.0%; 14.4%, respectively) and non-Hispanic whites (2.6%; 9.7%, respectively) (192). Orlander et al (193) found that Mexican Americans with (but not without) diabetes had higher mortality rates than their non-Hispanic white counterparts after myocardial infarction. One explanation for the increased diabetes complication and mortality rates among Latino/Hispanics, as well as other ethnic minorities, may be due to the indirect (e.g., cardio-metabolic) effects associated with poorer glyce-mic control. For example, 34.2 to 36.5% of ethnic minority patients have an A1C <7% (53 mmol/mol), compared with 48.4% of non-Hispanic whites (194). Boltri et al (195) found an average A1C of 8.2% (66 mmol/mol) for Latino/Hispanics, compared with 8.1% (65 mmol/mol) for non-Hispanic blacks and 7.6% (60 mmol/mol) for non-Hispanic whites. Excess mortality among Latino/Hispanics with diabetes may be due to other cardio-metabolic risk factors. In the Insulin Resistance Atherosclerosis Study (196), Latino/Hispanics, compared with African Americans and non-Hispanic whites, had greater percentages of untreated diabetes and albuminuria and lower percentages of aspirin (with coronary artery disease) and lipid-lowering agent use.

Behavior and Social Determinants

In part, the poorer glyce-mic control may be due to lower adherence rates with many aspects of diabetes care. Specifically, there is less adherence with SMBG among ethnic minorities, including Mexican Americans (197). Intensive insulin therapy is also used less often in Mexican Americans (and non-Hispanic, African Americans) than non-Hispanic whites (197), even though with a longer history of diabetes, the overall use of insulin increases (198). Fears of using insulin stem from concerns about hypoglycemia, weight gain, pain, teaching time, effort with single or multiple injections, complications related to the underlying condition (e.g., amputation and blindness), trust in the recommendation, and value relative to alternative folk remedies (199,200).

In another study, adherence with newly prescribed diabetes medications (including noninsulin therapies) is less in Latino/Hispanics, even English-speaking Latino/Hispanics, compared with Caucasians (201). In fact, language barriers are significant among Latino/Hispanics, with 21% not speaking English, and only 5% of physicians and 2% of nurses being Latino/Hispanic (202). As with other ethnic minorities, there is more distrust of an HCP representing a different ethnicity or where there is a significant language barrier (203,204). In Brazil, one technique used to assist with the care of children with type 1 diabetes mellitus, where language issues can be significant, involves instructional therapeutic toys (205).

Social problems significantly contribute to poor diabetes care among Latino/Hispanics. In general, Latino/Hispanics in the U.S. live with an employed family member but have higher rates (compared with Caucasians) of living below the poverty level (22% versus 10%) and being noncitizens (23% versus 2%). Education and household income rates are also relatively low among Latino/Hispanic households (206). Insurance coverage may play a significant contributory role to poorer glyce-mic control, with about 16.1% of Latino/Hispanics unin-sured, compared with 10.6% of African Americans, 7.3% of Asian Americans, and 6.3% of non-Hispanic whites in 2017 (197,207).

Belief systems that are unique to an ethno-cultural group can influence behaviors and therefore adherence and clinical outcomes (208). Among Latino/Hispanics, symp-tom improvement may equal a cure and therefore justify discontinuation of a medication. There are also generaliza-tions and fatalism: “If it happened to my aunt, then it will happen to me, so why do it?” In addition, there is a belief that taking more medications means the condition must be worsening. As a result, patients can remain in poor glyce-mic control with persistent monotherapy, contrary to the evidence-based AACE CPG and CPA (122,123). Latino/Hispanics may take medications given to them by friends or relatives and then discontinue their own prescribed drugs (209). Due to respect for the doctor, Latino/Hispanics with diabetes may not complain about side effects but will also surreptitiously discontinue the medications to avoid the side effects (209). White et al (210) found that health literacy in Latino/Hispanics was associated with trust and diabetes-related self-care activities. Of course, adverse economic pressures can aggravate negative or mitigate positive behaviors (201).

Diabetes Care

Solutions to these issues for Latino/Hispanics may involve greater incorporation of mid-level HCP and community health workers, particularly in large minority urban centers (211,212). Moreover, using culturally sensi-tive printed and web-based materials, as well as training HCP to be culturally sensitive and learn basic Spanish phrases, is recommended. For example, the Diabetes Attitudes Scale, which assists educational strategies to assist HCP, has been culturally adapted for Brazil (213). A 2-stage cultural adaptation process was developed by Rosas et al (214) to better apply Diabetes Prevention Program (DPP) interventions for Latino/Hispanics in the U.S., involving family members, coaches, smartphone applications, and healthy, easy, and low-cost culturally appropriate meals. Key thematic approaches to caring for Latino/Hispanic patients with diabetes are:

- Language-concordance among HCP (and using inter-mediaries/translators as needed),
- Avoidance of switching familiar HCP,

- Nurturing an empathic connection by the HCP,
- Having an HCP-driven visit agenda (rather than a less formal active collaboration), but also
- Having a patient-driven problem-based visit (rather than a formulaic chronic disease prevention and treat-ment-oriented visit) (215).

Asian American

Demographics and Biology

The Asian American population is the fastest grow-ing racial group in the U.S. since 2000 (60% increase from 2000 to 2010), with 21 million people in 2015 (3.4% growth rate from 2014 to 2015, compared with 2.2% for Latino/Hispanics, 1.5% for Native Americans, and 1.3% for African Americans for the same 1-year period) (216). By 2060, the Asian American population is projected to be 34.4 million, or 8.2% of the U.S. population (216). Caring for the Asian American population is challenging due to considerable diversity: at least 23 countries, 19 languages, and 4 different major religions represented, with vary-ing incomes (highest median income but also high rate of poverty) and education levels. Consequently, it is impor-tant for HCP to be familiar with basic geography toward an understanding of “Asian” culture.

South Asians are from Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. *Southeast Asians* are from Vietnam, Laos, Cambodia, Thailand, Myanmar, Malaysia, Andaman and Nicobar Islands of India, Indonesia, Singapore, Philippines, East Timor, Brunei, Christmas Island, and the Cocos Islands. *East Asians* are from China, Hong Kong, Macau, Mongolia, North Korea, South Korea, Japan, and Taiwan. *Central Asians* are from Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The term Western Asia has limited use due to overlap with the Middle East, and gener-ally includes transcontinental countries, such as Egypt and Turkey, as well as those on the Arabian peninsula (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, and Yemen), the South Caucasus (Abkhazia, Armenia, Artsakh, Azerbaijan, Georgia, and South Ossetia), the Fertile Crescent (Iraq, Israel, Jordan, Lebanon, Palestine, and Syria), Iran, Cypress, and Northern Cypress. *North Asians* are from Siberia. The term “Asia-Pacific” is impre-cise, as it overlaps much of Asia and includes many other small islands.

The more populous Asian American ethnic groups, in descending order of 2015 population numbers, are Chinese (4.9 million), Indian (4.0 million), Filipino (3.9 million), Vietnamese (2.0 million), Korean (1.8 million), Japanese (1.4 million), Pakistani (0.5 million), Cambodian (0.3 million), Hmong (0.3 million), and Thai (0.3 million) (220). Additionally, for 2015, 74% of Asian Americans were foreign born, 57% U.S. citizens, 55% with proficient English, 51% living in the U.S. for more than 10 years,

48% with a bachelor's degree or higher, and 35% with a high school education or less (217).

Biologically, there are specific gene variants that are associated with diabetes susceptibility and expression in Asians. The *GLUT-4* rs5435 and His1085His *INSR* gene variants are associated with T2D (70,218), and *CDKALI* rs7754840 and rs7756992 gene variants are associated with gestational diabetes (219), in South Asians. In addition, GWASs have identified 7 novel loci for T2D risk in the Japanese population, while the peroxisome proliferator-activated receptor (*PPAR*) α rs1801282 gene variant is associated with a thiazolidinedione (TZD) target, and the *KCNJ11*, *KCNJ8*, and *ABCC8* rs5215 gene variants are associated with sulfonylurea and glinide targets (220).

In the tumor necrosis factor- α protein network, the 308G/A polymorphism is a potent risk factor for T2D in Asian Indians over age 45 years (221). Among Asian Indians, there is a particular phenotype: sarcopenic obesity or "thin-fat" body composition due to decreased muscle mass and increased visceral adiposity, higher plasma nonesterified fatty acid and triacylglycerol levels, hyperinsulinemia and insulin resistance, higher hsCRP and lower adiponectin levels, and possibly reduced β -cell function (222,223). Another uncommon form of diabetes occurring in Asian Indians is fibrocalculous pancreatic diabetes, a chronic, inflammatory, and nonketotic disorder unassociated with alcohol use but typically associated with a lean adolescent or young adult, with recurring episodes of abdominal pain and steatorrhea, and associated with a relatively high pancreatic malignancy risk (224).

Behavior and Social Determinants

Acculturation to American lifestyles by Asian Americans has contributed to increased cardio-metabolic risk. Specifically, longer U.S. residency is positively associated with BMI among a diverse Asian American population (225); 58.1% of Asian American adults have central obesity (by WC; NHANES 2011-2014) (226), and U.S.-born Japanese American women have higher body fat amounts than their immigrant counterparts (227). Even vegetarian dietary patterns can differ among Asian populations and U.S. practices. For instance, there are subtle differences between the vegetarian patterns for immigrant South Asians (relatively more dairy, legumes, vegetables, fruit, desserts, and fried foods) and Americans (relatively more legumes, fruit, whole grains, and less refined carbohydrates, desserts, fried foods, juices, and soft drinks) (228). Lactose intolerance among Asians also needs to be better clarified (229). In addition, and notwithstanding economic pressures, fast foods need to be discouraged (230). Misconceptions about foods should also be addressed, such as avoiding "strong" foods, (white sugar, lamb, beef, ghee, and spices) and increasing "weak" foods (rice and cereals, or other phytotherapies, such as bitter gourd, okra, and grapefruit) (231).

Asian anthropometrics differ significantly from those for Caucasians, African Americans, and Latino/Hispanics. While current epidemiologic studies have demonstrated shortcomings in the predictive and correlative power of BMI and total body fat for different ethnicities, the current AACE adiposity- and dysglycemia-based chronic disease models (109,169) may better explain how body composition affects diabetes pathophysiology and management for different populations. In general, Asian Americans have higher percentages of intra-abdominal fat according to World Health Organization and International Diabetes Federation BMI cutoffs of ≥ 23 kg/m² for overweight (≥ 25 kg/m² for non-Asians) and ≥ 25 kg/m² for obesity (≥ 30 kg/m² for non-Asians); and WC cutoffs for central adiposity of 90 cm for men (about 100 cm or 40 inches for non-Asian men) and 80 cm for women (about 90 cm or 35 inches for non-Asian women) (229). While WC should be a routine measurement along with weight and height for all patients, this measurement is especially important in those of Asian ancestry.

Demographic and economic transitions, including acculturation to an American way of life, have contributed to increased risks for chronic metabolic diseases among Asian Americans: shifts in proportion of animal foods from 9.3 to 13.7% (Chinese) or 17 to 31% (India), and fat from 22 to 29.8% (China) (232,233). Asians with T2D are also more prone to have postprandial hyperglycemia, in part due to decreased β -cell mass, and therefore can benefit from dietary patterns with foods having lower glycemic indices and loads (223,229,234-237). However, in those patients with insulin-requiring T2D, Asians require higher basal dosing than Caucasians (238). Greater success with Asian patients can be accomplished through the use of multidisciplinary teams for education, especially for patient-led titration, and with the use of technology, such as smart phone apps and web-based communication with physicians (238).

Lifestyle interventions in Asians have demonstrated benefits in progression to diabetes from prediabetes, all-cause mortality rates, and cardiovascular mortality (229,239). Reverting to more traditional Asian dietary patterns is advised; as examples, this would include green tea, rich variety of vegetables and fruits, spices, low red meat consumption, beans and nuts, fish and seafood, fruits for dessert, whole grains, smaller portion sizes, and increased soy consumption. Specific items to avoid or dissuade include: white rice and other refined grains (can substitute or mix in whole grains and pulses [beans, peas, lentils, and other seeds from legumes]) (240), use of animal fat and palm oil (can substitute healthier plant-based oils, such as canola, safflower, sunflower, walnut, olive, etc.), unhealthy *trans* fats, which can be unlabeled on packages (can educate patients and teach how to read and interpret Nutrition Facts labels), tea or coffee with too much added sugar (can substitute viscous natural sweet-

eners, such as honey or agave nectar), too much salt (to emphasize fresh produce rather than canned and processed foods), and excessive consumption of pickled vegetables and cured meats (to educate about the health risks of these products). For example, among Korean Americans, the average dietary sodium intake was 3,433 mg/day, primarily from bicultural dishes, such as noodles and dumplings, Korean-style soups, kimchi, bread and snacks, and boiled or seasoned vegetables (241). Male Koreans recently diagnosed with T2D and who consumed excessive calories were likely to overconsume sodium (241).

In general, Asian Indians are more sedentary than Caucasians, and lower levels of physical activity are inversely correlated with BMI, WC, systolic blood pressure, plasma glucose, plasma insulin levels, and overall cardiovascular risk (242,243). Unfortunately, there are cultural beliefs that physical activity cannot prevent complications and that it can be harmful (“the elderly should rest;” unsafe for women to exercise outside the home) (231). However, in a randomized controlled trial (RCT) of 70 Gujarati Hindu subjects in collaboration with a Hindu temple in Houston, Texas, receiving a 12-week lifestyle intervention program (based on the DPP), patients in the intervention group had significantly improved A1C and WC, compared with the control group (244). The intervention incorporated traditional Gujarati cultural and religious practices, with cooking demonstrations, grocery store tours, and healthy food samplings.

In Islam, health is only second to faith in terms of importance, and idleness is prohibited (245,246). The prevalence of physical inactivity among 38 Muslim countries was 32.3% in a 2015 report, with women and Arabs more likely to be physically inactive than their respective counterparts (247). In certain Muslim practices, women are covered when in public (e.g., the voluntary practice of hijab, or veiling), which can impact participation with outdoor exercise programs, particularly swimming (248,249). For hijabi athletes, certain adaptations have facilitated exercise, such as running: performance (lightweight, cooler, and water repellent) hijabs, wireless headphones, and joining running groups. Mosque-based physical activity programs can also be beneficial (250). There are culturally appropriate forms of dance and other body movements that can be encouraged (231). Stigma and logistical issues associated with sweating and subsequent prayer can be an impediment to strenuous exercise. Because of these behavioral factors, many Asians may lack the confidence attending and participating in a medical fitness class or simply working out in a gym (231).

Diabetes Care

There are many challenges to optimizing diabetes for Asian Americans, but the two main challenges are (1) community-based culturally appropriate educational/awareness programs for older patients, and (2) time

constraints to implement recommendations for younger patients (251). As with other ethnic minorities in the U.S., there are limited data specific for the Asian population, prompting the need for more research. In a study by Peimani et al (252) of the Persian (Farsi language) medical literature, patient-perceived communication is a significant modifiable approach to improve clinical outcomes (via self-management, adherence, and self-efficacy) in patients with T2D. Specifically, HCP empathy, cultural sensitivity, explanation, and shared decision-making are targets for improvement (252). For Filipinos, social vulnerabilities should be addressed, such as financial challenges, limited social support, life instability, and important cultural values (need for family involvement, fatalism, politeness, face-to-face contact [trust], and interpersonal relationships and shared experiences) (253). In a study using questionnaires about diabetes self-care, diabetes distress (and a focus on diabetes-related diseases) was a strong predictor of glycemic control in Japanese American women, compared with emotional support as a strong predictor in Japanese women (254). A comparative effectiveness RCT is underway investigating a faith-based DPP versus a Pacific culturally adapted DPP for Marshallese in the U.S. (255). The Kerala DPP (256) is a culturally adapted peer-led lifestyle intervention program for diabetes prevention in India and represents another example of programs that can be developed for Asian Americans.

Pharmacologic responses can also differ for Asians with diabetes, calling for specific transcultural modifications to CPG and CPA. Among clinical trials, post hoc analysis of the EMPA-REG and CANVAS clinical trials show that empagliflozin had more cardiovascular benefits in Asians than canagliflozin (in contrast, African Americans had greater cardiovascular benefits with canagliflozin) (257). However, in multiple clinical studies, and notwithstanding a theoretical advantage of glucose-lowering in Asians (who may have more of a β -cell impairment), there were similar clinical efficacy and safety data results with sodium-glucose cotransporter-2 inhibitor (SGLT2i) use among Asians, Caucasians, African Americans/Blacks, and other racial groups (258-263). In a pharmacogenomics study involving Taiwanese patients with T2D, there were 45 gene variants associated with therapeutic responses to dipeptidyl peptidase-4 inhibitors, with an affirmation that β -cell dysfunction plays more of an etiologic role than insulin resistance in Asians (264).

Holidays and other social events—both secular and religious—are frequent and can disrupt healthy dietary patterns because of fasting or feasting (265,266). Oftentimes, Asian Americans will travel to their homelands for these events and deviate from their healthy lifestyles (265). Missed clinic appointments and poor medication adherence are also common with holidays and social events, necessitating flexible appointment slots (251). Reluctance to take full medication doses and disclose

adherence issues or alternative therapies to their doctors is also a problem (231).

There are also belief systems deeply rooted in non-Western or alternative care medicine that can disrupt diabetes care (267). In a systematic review by Sohal et al (231), most South Asian patients trusted their HCP, despite significant language barriers with appropriate translation services only intermittently available. Many Asian patients viewed self-management or autonomy negatively, and the physician (not dietitian or other HCP) was the best authority for advice (231). Another challenge for the physician is the relative lack of time during a routine encounter to grapple with these challenges, as well as other economic, social, and cultural factors, giving the appearance of apathy (231).

Ramadan is a holiday in the ninth month of the Islamic calendar, observed by Muslims worldwide, and deserving of special discussion here. Obligatory fasting applies for all Muslims, with certain exemptions for illness and other circumstances, including diabetes (268). Fasting is from dawn until sunset, and Muslims must refrain from smoking, sexual relations, consuming any food or liquids, or participating in any behavior considered to be sinful during this time. The prefast meal (“suhur” or “suhoor”) is observed before dawn, and a fast-breaking meal (“iftar”) is observed at sunset and may be an elaborate, banquet-style meal. Traditional dishes are consumed with these meals, including desserts, dates, salads, appetizers, and meats. Despite a potential exemption for diabetes, many patients with diabetes insist on fasting despite a higher risk of hyperglycemia, diabetic ketoacidosis, or hypoglycemia, especially if taking insulin.

Patients observing Ramadan should be managed according to risk stratification for hypoglycemia, hyperglycemia, comorbidities, and an understanding of their chronic disease (268). Insulin therapy should be individualized prior to starting the fast, and premixed insulins should be avoided (268). Glucose levels should be monitored closely. The Suhoor should be consumed just before sunrise, have more slowly absorbed food (low glycemic index), such as basmati rice and dhal (dishes from pulses), along with fruits, vegetables, and a lean protein source, and include little or no sweet or fatty foods (268). Specific dishes suitable for the Suhoor meal in patients with diabetes include:

- Whole-grain cereal, low-fat milk, cottage cheese with sliced peaches topped with toasted almonds,
- Plain Greek yogurt, flavored with blueberries and cinnamon, whole-wheat toast with nut butter,
- Foul (a middle eastern breakfast dish with lentils or fava beans) with a small serving of sliced fruit, or
- Whole-wheat roti (unleavened bread) and egg khagina (a seasoned omelet-like dish).

Excessive physical activity should be avoided during fasting to minimize any risks for hypoglycemia (268). The

fast should end if hypoglycemia occurs or if the glucose is >300 mg/dL (268). The Iftar should be accompanied by plenty of water or sugar-free beverages (268). Overeating, sugar, and caffeine should be discouraged at the end of the fast (259). Dates should be limited to only 1 to 2 each night (268). Whole grains, lean meats, fish, poultry, and unsaturated fats are recommended with the Iftar (268).

Diabetes pharmacotherapy should be modified during Ramadan. For example, metformin is typically given at equal doses several times a day, then changed to a lower dose with the Suhoor and a larger dose with the Iftar (268). No changes are required for TZDs, alpha-glucosidase inhibitors, or incretin-based therapies (268). If already prescribed, once-a-day sulfonylurea doses should be adjusted based on glycemic status and risk for hypoglycemia and should be given with the Iftar (268). Twice-a-day sulfonylurea doses should be reduced by half or stopped with the Suhoor, with the usual dose with the Iftar (268). Despite an association with diabetic ketoacidosis during periods of prolonged fasting, SGLT2is are not associated with adverse events during Ramadan (ketonemia, reduced eGFR, or hypoglycemia) and could be continued without dosing adjustments, but with more diligent hydration (269-271). Insulin analogs should be adjusted based on risks for hypo- and hyperglycemia, and if on premixed insulin, to consider changing to long-acting insulin in the evening and rapid-acting insulin with meals (half-dosing with the Suhoor and usual dosing with the Iftar) (268).

Native American

Demographics and Biology

The Native American experience with diabetes offers great potential for learning about the impact of cultural competency on diabetes care, notwithstanding the relatively small population numbers compared with other U.S. ethnic minorities. From 1994-2002, the *age-adjusted* prevalence of diabetes among adult Americans increased from 4.8% to 7.3% (52.1% relative change), but among Native Americans, it increased from 11.5% to 15.3% (only a 33.0% relative change) (272). This implicates selective influences of (epi)genetic and environmental factors on diabetes pathophysiology in Native Americans. However, in another study, the *overall* prevalence of T2D among Native Americans increased 68% from 1994 to 2004 and is about 2 to 3 times that of non-Hispanic whites, reinforcing the concept that diabetes drivers may be somewhat unique when considering Native Americans (273,274). Associations of various genetic factors and traits among Native Americans, particularly in Pima people, are provided in Table 3 (85-88).

It is important to note that the presentation of T2D and appearance of complications are at younger ages among Native Americans (273,274). Prediabetes occurs in approximately 30% of Native Americans (273,274). Diabetes

mortality had been underreported in the past due to incorrect racial classifications, but it has now been corrected in the American Indian/Alaskan Native Mortality database, which is linked to the Indian Health Service (IHS) registration (275). From 1990–2009, 41% of Native Americans with diabetes <65 years of age died, compared with only 23% of non-Hispanic whites (275). Compared with non-Hispanic whites, the relative risk for diabetes mortality from 2000 to 2009 was increased in all Native American regions (Northern Plains 4.71; Southwest 4.52; East 3.16; Southern Plains 3.19; and Pacific Coast 2.74) except for Alaska (0.96) (275). These figures also demonstrate variability in diabetes prevalence rates, particularly with lower rates for the Pacific Northwest and Alaska, invalidating the perception that diabetes is severely endemic across all Native American entities. The mortality rates for Native Americans began to decline in 1997 with implementation of the Special Diabetes Program for Indians of the IHS (266). In 2017, 37% of IHS costs were related to diabetes care (276). Overall, diabetic eye disease rates decreased by 50%, kidney failure rates by 54%, and no changes in obesity or diabetes rates in youth over 10 years or adults since 2011 (276).

In a 2005–2011, California Health Interview Survey (277) of a multiracial population, where the total weighted prevalence rates for overweight/obesity are 55.96%, the rates for Native Americans (71.74%) and Pacific Islanders (64.57%) were comparable to those of Latino/Hispanics (68.39%), blacks (68.10%), and non-Hispanic whites (56.15%) but much higher than Asians 34.94%. Apart from Pacific Islanders, overweight/obesity rates among the ethnic minorities correlate with diabetes and other health disparities, such as poor/fair health and physical disability (277). In a study of tribal college students in the Midwest and Northern Plains from 2011–2014, 68% of participants were found to be overweight/obese, with a mean BMI of 28.9 kg/m² (278). In addition, 96.6% fail to meet recommendations for vegetable intake, 78.7% for fruit intake, and 65.6% for physical activity (278). Subjects also underestimate their weight category: 54.2% of males compared with 35.1% of females (278).

Behavior and Social Determinants

Physical inactivity is a challenge for Native Americans, as culture transitioned from an active to sedentary lifestyle in reservation-based communities because of forced displacement. This is an important factor when comparing Arizona Pima and Mexican Pima peoples, where the former have a much higher diabetes prevalence rate compared with the latter (54% versus 6% for males; 37% versus 11% for females, respectively) (279). In American reservation-based communities, there is a lack of facilities, equipment, and trained staff for exercise programs, and furthermore, there is a need for culturally appropriate family-oriented physical activities, childcare to allow the adults with children to participate, community centers, outdoor walking trails, and school gymnasiums that are open for public use (280).

Historically, indigenous foods varied by region and consisted of natural, unprocessed, whole foods from both plants and animals (Table 7) (281). However, due to a variety of dietary transitions, a less-healthy eating pattern emerged. From 1860–1934, government rations were provided to supplement failed crops, but these rations were culturally inappropriate, nutritionally inadequate, and generally of poor quality (273,282). From 1920 to the 1950s, canned meats and fish, bread, and sugar were provided, but again, the food aid did not include traditional food ingredients (273,282). Malnutrition and hunger were problematic, and diabetes was essentially unknown in the population (273,282). In the 1950s, the Native American diet was dictated by government commodities, and the emergence of diabetes followed (273,282). In the 1960s, the Native American dietary pattern was similar to the general American population, and diabetes was diagnosed with increased frequency among Native Americans (273,282).

Because of governmental control during these time periods, there was disruption of family and tribal structure with residential schools and outlawing of religion and native languages (273). Tribal land was reduced, and there were limited rights to fish, hunt, and collect wild foods (273). “Food deserts” appeared due to the geographic

Table 7
Indigenous Native American Foods by Region^a

Type	Great Plains	Northwest	Southwest
Plant	Beans, Buffalo berry, Camas bulb, Chokeberry, Currant, Plum, Turnips, Hackberry	Acorns Many different plants	Pinon nut, Screwbean, Cacti century plant, Mesquite bean, Agave, Mescals, Acorn, Berry, Seeds
Animal	Antelope, Beaver, Buffalo, Deer, Duck, Elk, Muskrat, Prairie Dog, Rabbit, Raccoon, Porcupine, Prairie chicken, Skunk, Wolf pup, Bison	Salmon, Trout, Halibut, Herring, Marine mammals (Whale, Otter, Seal), Bear, Beaver, Lynx, Deer, Small game (Rabbit, Hare)	Insects, Turkey, Deer, Rabbit, Fish, Antelope

^aAdapted from Recovering Our Ancestors' Gardens: Indigenous Recipes and Guide to Diet and Fitness, University of Nebraska Press; 2005 (281).

and logistic isolation, leading to further food insecurity, poorer nutrient quality, and hunger (273). In addition, there were efforts to assimilate Native Americans into a European system, with industrial and agricultural training provided, but with relatively little academic instruction (273). Cavanaugh et al (274) conducted a survey of Native Americans in Oklahoma and identified several attitudes and beliefs about diabetes resulting from this cultural disruption: fear about complications and death; fatalism (inevitability) about developing diabetes; denial and hence an avoidance of screening or care for infections; knowledge of dietary issues and that reverting to a traditional diet would be beneficial; and the high cost of food.

From the 1970s to the 2000s, there were significant U.S. policy shifts regarding Native Americans: Congress implemented the Food Distribution Program on Indian Reservations, administered by the U.S. Department of Agriculture, Indian Tribal Organizations, and State Organizations (involving 276 tribes and 75,608 participants in 2003), as an alternative to the Supplemental Nutrition Assistance Program (282). When random samples of food packages under this program were analyzed according to the Healthy Eating Index 2010 (HEI-2010) (283), the average score was 66.38 ± 11.60 (maximum = 100), comparing favorably to gradually improving average U.S. HEI-2010 scores of 49.1 (from 1999-2000) to 59.0 (from 2011-2012) (282,284).

Diabetes Care

In 1997, a \$150 million annual grant was established by congress for Special Diabetes Programs for Indians, coordinated by the IHS Division of Diabetes and Tribal Leaders Diabetes Committee, focusing on primary prevention of T2D and cardiovascular disease risk reduction. In 2004, additional funding was provided to translate data from diabetes prevention research. As a reference, there were only 171 Native American subjects in the DPP study reported in 2002 (compared with 1,768 non-Hispanic whites, 645 African Americans, 508 Hispanic whites, and 142 Asians) (285). Five best practices were selected by the IHS as diabetes prevention programs for Native Americans:

- “Trim down” – in New Mexico and a 6-week intervention,
- “Lifestyle Balance Program” – at Gallup Medical Center and a 22-week application of the DPP curriculum,
- Trials of the Iroquois – at the Lionel R. John Health Center and a weekly session with progress tracked with a clan animal and using beads and leather for weight loss,
- Red Lake Band of Chippewa Indians Weight Management Program – two times per week for 6 to 8 weeks with lifestyle and group support, and
- Fresno Native American Health Centers Greatest Loser Program – urban setting for 10 weeks involv-

ing behavioral modification with spiritual and mental health approaches (273,276).

In the Special Diabetes Program for Indians Diabetes Prevention demonstration project, involving 36 health care programs serving 80 tribes and recruiting 2,553 subjects, there was a curriculum of 16 sessions of lifestyle balance with a 3-year follow-up (286). Completion rates were 74, 59, 42, and 33% for the immediate postcurriculum and years 1, 2, and 3, respectively (277). After 26 weeks, there was an average 9.6-pound (4.4% body weight) loss, with 17.5% of subjects achieving the 7% weight loss goal at 3 years (286). Moreover, the diabetes incidence rate of 7.5% at 3 years in those attending <16 sessions was reduced to 3.5% when all 16 sessions were attended (286).

The Life in BALANCE study (287) was a pilot translational study modeling the DPP intensive lifestyle coaching and targeting urban Native Americans in Las Vegas, Nevada. Subjects were “at-risk” with BMI ≥ 25 kg/m² and A1C 5.4 to 6.4% (36 to 46 mmol/mol), with 22 enrolled in a 16-week core program, but only 12 remained for the last follow-up (286). Notwithstanding the small study size and relatively short study period, various cardio-metabolic risk factors significantly improved: -5.79% weight; -4.34% WC; and $+12.92\%$ HDL cholesterol; with nonsignificant changes in TGs, fasting glucose, and systolic and diastolic blood pressure (286).

In the Tribal Turning Point study, 62 overweight/obese youth (7 to 10 years old; from 52 families) from the Eastern Band of Cherokee Indians and Navajo Nation were randomized for an 8-month randomized pilot study (288). Subjects participated in 10 classes over 4 months with a caregiver and counseling, 10 to 20 minutes per class of physical activity, interactive learning with games, cooking demonstrations and group meals, and a cultural context through crafts and language (288). The BMI increased by 1.0 kg/m² in the control group but not in the intervention group (288).

For Native Americans, diabetes education is better received from insiders and not outsiders. “Talking Circles” are used in Native American communities for group processing of information, using the oral tradition (289). The meeting area is cleansed with sage, prayer is conducted, and offerings of tobacco and food made to the spirits (289). In another study of Native American women, Goins et al (290) found that A1C and poor diabetes control correlated with psychological trauma and low social support. In the Traditional Foods Project (2008-2014), local HCP and community members were engaged to prevent T2D through sustainable, evaluable, and ecological approaches (291). A network of other programs to benefit Native Americans that emphasize physical activity as part of T2D prevention include those funded by the Special Diabetes Program for Indians, the Together Raising Awareness for Indian Life (TRAIL), the IHS National Congress of American Indians and Division of Diabetes Treatment and

Resource	Description
www.ihs.gov/diabetes	Indian Health Services toolkit
www.diabetes.org/in-my-community/awareness-programs/American-Indian-programs	American Diabetes Association
www.laplaza.org/health/dwc/nadp/	Native American Diabetes Project Diabetes Wellness Connection for information on how to control and prevent diabetes
www.aihd.ku.edu/	American Indian Health and Diet Project
Devon Mihesuah. <i>Recovering Our Ancestors' Gardens: Indigenous Recipes and Guide to Diet and Fitness.</i> University of Nebraska Press; 2005.	Information about Native Americans' health and fitness

^aAdapted from Indian Health service, The Federal Health Program for American Indians and Alaska Natives. Division of Diabetes Treatment and Prevention (276).
Available at: <http://www.ihs.gov/MedicalPrograms/Diabetes/index.cfm?module=toolsBestPractices>.

Prevention, Boys and Girls Clubs, Nike, FirstPic, Inc, and the Office of Women's Health (280). In a Canadian study on indigenous patients, participation in a continuing medical education workshop incorporating cultural and social dimensions by family physicians improved knowledge, skills, and confidence about diabetes management (292). Other resources for Native American patients with diabetes are provided in Table 8 (276).

DISCUSSION

Biological Factors

Epigenetic programming is a mechanism by which past exposure to T2D-specific factors can affect cellular function and disease expression. This mechanism represents the biological underpinning of how culturally dictated environmental variables can influence pathophysiology. As an example, Andersen et al (293) showed that pre-adipocytes can be epigenetically reprogrammed by extracellular factors, primarily related to PPAR signaling. In addition, epigenetic pathways that control glucose-induced upregulation of endothelin-1 contribute to metabolic memory phenomena (294). The data presented in this position statement represent patterns of genetic variability with certain races and ethnicities, as well as patterns of environmental variability with certain cultures (Fig. 3). Consequently, the clinical expression of diabetes and response to management is unique, owing to the complex interactions of the environment, epigenome, and genome, and hence, compels HCP to incorporate cultural factors as part of any individualization process. Therefore, one important goal in the transculturalization of diabetes care is to understand the biological rationale for specific adaptations, depending on the ethnic minority being studied, to maximize success. This will require more scientific research, which in turn, requires a pragmatic needs assessment for dedicated funding on biological-cultural interactions as drivers of diabetes.

Lifestyle Factors

Lifestyle medicine is the nonpharmacologic and nonsurgical management of chronic disease. The elements of structured lifestyle change needed to improve prevention of T2D, and management of any type of diabetes should be culturally adapted on a routine basis to optimize outcomes. In general, the main elements are dietary patterns, physical activity, behavioral medicine, stress reduction, tobacco cessation, and sleep hygiene. Adaptations by HCP to improve lifestyle for ethnic minorities in the U.S. require a deeper understanding of specific cultures than typically taught in medical school and postgraduate training programs. Formal training in nutrition, physical medicine, behavioral medicine, sleep medicine, and direct mentorship in cultural competency should be part of diabetes educational programs. Outpatient center infrastructures will need to be modified for more immersive settings based on the cultural composition of a particular practice. Practice preparedness will include capabilities for either on-site or facilitated referrals for diabetes and other wearable technologies, nutritional counseling, medical fitness, and community engagement. Culturally appropriate apps and other web-based tools should be configured and made accessible for patients, especially those in lower socioeconomic strata. Newer medical economic models will need to be fashioned so that these elements of lifestyle medicine can be provided, where ultimate costs of diabetes care can be reduced on a population scale.

Behavioral Factors

In 2012, nonadherence to medications accounted for the greatest avoidable costs in the U.S. healthcare system (\$105.4 billion) (295). Various behavior change techniques can be used to improve medication adherence across different cultures (Table 9) (296-298). There will need to be greater exposure to behavioral medicine education in medical school and postgraduate programs, along with mentorship and direct supervision so that HCP can

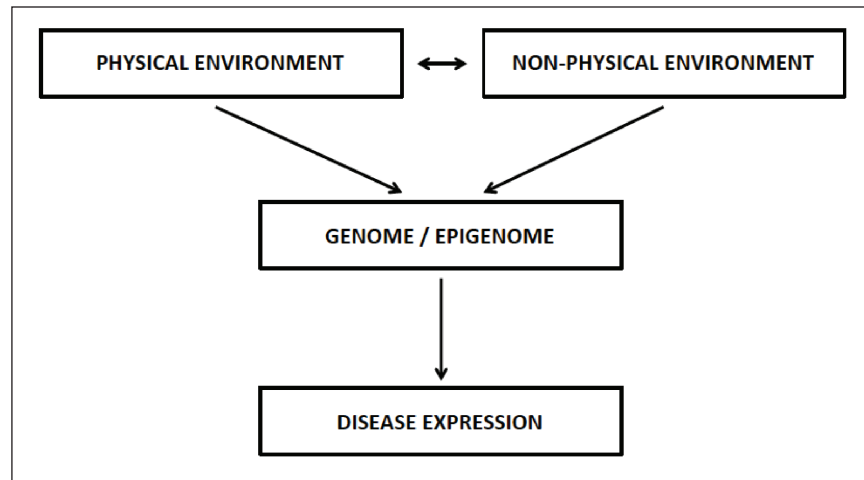


Fig. 3. Complex interaction between biological and cultural factors in disease expression. Physical examination includes the natural environment, such as climate, terrain, and geography, as well as the man-made or built environment, such as buildings, roads, running paths, and pollution. Nonphysical environment overlaps with cultural factors for specific ethno-racial populations, such as socio-economics, religion, politics, culinary preferences, crime, and other manners of living. The genome contains specific gene variants that are found in certain ethno-racial populations. The epigenome changes in response to various environmental factors. Disease expression results from the genome and epigenome.

hone their skills. As part of this process, HCP behaviors will need to be culturally adapted and metrics embedded into electronic health records for feedback and optimization as part of the diabetes chronic care model. Specific tutorials should be implemented for motivational interviewing that incorporate elements of trust, empathy, appropriate nonverbal communication, and respect for personal space, depending on the specific ethnicity encountered. Meme generators can also be employed and are amenable to cultural adaptation and diabetes care (e.g., reflecting a child/adolescent with diabetes interpretation of their pancreas' current mood) (299).

Sociological Factors

Disparities among different ethno-racial populations in diabetes care and outcomes are due to differences in social determinants of health, including access to health-care and adherence with medications, disease presentation, and perplexing difficulties implementing structured intensive lifestyle change. No doubt, economic factors and discrimination contribute to disparities in access to high-quality medical care. It is particularly interesting that in a Boston Area Community Health Survey of highly insured African American, Latino/Hispanics, and Caucasians with diabetes by Goonesekera et al (300), there were, in fact, no disparities in diabetes treatment patterns and glycemic control—this emphasizes the impact of economic class on disparities in care. Generally speaking, social capital (trust, norms, and networks that facilitate cooperation for mutual benefit in a community) is associated with overall health, chronic noncommunicable disease prevention, and risk behaviors (301). More specifically, social capital can be

protective for diabetes and obesity, but this is still poorly understood, particularly in the context of different education levels, socioeconomic classes, and cultures (301). For instance, in those with social capital that supports behavioral change, a diagnosis of prediabetes can lead to positive lifestyle change, but in those with inhibitions and decreased social capital, such as poor housing, low material wealth, unsupportive environments, and conflicting cultural influences, behaviors are unlikely to improve (302). Taylor et al (303) concluded that cultural competency training and experiential learning were the best ways to identify and address health disparities.

Health messaging and literacy are key components of HCP-patient interactions. For instance, in the case of Native Americans who continue to suffer from social injustices, intergenerational trauma, and the persistence of health disparities, a critical message, and one that incorporates appropriate phrases that can be delivered by the HCP to the patient, is that Native Americans “matter” (304).

Social prescribing is another tool amenable to the cultural adaptation process for diabetes care and is characterized by referrals to nonmedical support services in the community and voluntary sector (305). Examples include referrals for exercise and physical activity options (e.g., dance, martial arts, community gym), public health improvement teams, community-based diabetes prevention programs, lifestyle and weight management programs, and other community engagement activities, including houses of worship (305). Leveraging web-based information is a central component to social prescribing, but whether there is net benefit to the care of patients with diabetes is unclear and requires further research (305).

Clinical Research

In a Canadian secondary analysis of a systematic review of quality-improvement studies for patients with diabetes, less than one-third of the trials included equity-relevant considerations, leading to a poor representation of how social and cultural determinants affect T2D expression and outcomes (306). Concerted efforts should be made to improve recruitment and retention strategies for clinical trials that better represent ethnic minorities in the U.S. This, too, will require an emphasis on greater trust and respect for potential study participants. Another contrib-

uting factor to poor representation of ethnic minorities in clinical trials may be related to inadequate representation of ethnic minorities in the research teams. These logistic and methodological issues will need further study.

Clinical Practice

The impact of cultural factors on the performance of the diabetes Chronic Care Model (307,308), as assessed by the Patient Assessment of Chronic Illness Care, remains unclear (309). In the recent AACE DBCD model (169), wherein insulin resistance, abnormal adiposity (based on

Table 9
Behavioral Techniques to Improve Medication Adherence Across Different Cultures^a

Sequential change technique	Description	Pragmatic action
Knowledge	General information Behavioral health consequences Individualization Memory enhancement	Create written and web-based tools Provide links for apps Transculturalize Validate with clinical studies
Awareness	Risk communication Self-monitoring Reflective listening Behavioral feedback	Use of risk stratification and scores Build diabetes technology infrastructure Use of continuous glucose monitors Wearable technologies to access performance Transculturalize Validate with clinical studies
Attitudes	Specific attitude changes	Documentation of patient attitudes Transculturalization Validate with clinical studies
Self-efficacy	Belief in ability to succeed Modeling, skill training Coping response Graded tasks Verbal persuasion	Create tools and programs http://www.apa.org/pi/aids/resources/education/self-efficacy.aspx Use of wearable technologies Transculturalize Validate with clinical studies
Intention formation	General intention and goals Medication schedule Specific if-then plans	Create a behavioral contract Written and web-based forms for medication dosing/schedule Transculturalize Validate with clinical studies
Action control	Cues and reminders to maintain intentions over time (297) Translate intention into action Self-persuasion Social support	Incorporate into wearable technologies and apps Transculturalize Validate with clinical studies
Maintenance	Maintenance goals Relapse prevention	“Nudges” built into wearable technologies and apps Transculturalize Validate with clinical studies
Facilitation	Ongoing professional support Dealing with adverse effects Individualization Simplifying regimen Reducing environmental barriers	Written and web-based information Protocols for reducing dosing intervals and using combination medications Transculturalization Validate with clinical studies
Motivational Interviewing	Patient-centered counseling style (298) Facilitates behavioral change Resolves ambivalence	Establish formal training for HCP Transculturalize Validate with clinical studies

^aTechniques validated from analysis of 60 studies with 34 demonstrating improved medication adherence (298). The configuration of increasing knowledge and self-efficacy was the most empirically relevant in this study (298). Table adapted from Kahwati L, et al. *Syst Rev.* 2016;5:83 (296).

the AACE ABCD model) (109), prediabetes, uncomplicated T2D, T2D with complications, and cardiovascular disease fall on a spectrum, there are six main aspects that are suitable for transculturalization:

- Healthy built environment,
- Reformed health care system,
- Activated patient,
- Prepared diabetes practice,
- Improved population-based outcomes, and
- Future innovations.

From a pragmatic standpoint, the transculturalization process is best envisioned as a modification to existing evidence-based guidelines, such as in Figure 2 for Latin Americans and Figure 4 as a broader update to the 2019 AACE/ACE Comprehensive Type 2 Diabetes Management Algorithm (310). Key nodes for transculturalization correspond to components of structured lifestyle change, accessibility (e.g., affordability) of pharmacotherapy, and enhancements on HCP-patient communication, health messaging, and community-based health care delivery systems.

CONCLUSION AND SYNTHESIS

An AACE transcultural diabetes chronic care disease model for the U.S. will guide decision-making to optimize outcomes, not only at the individual patient level, but also

on the larger population scale. This model is enhanced by transculturalizing each component of the AACE diabetes chronic care disease model (Fig. 5) (169). A summary of the core recommendations for transculturalizing diabetes care in America is provided in Table 10. For instance, patients should be asked what they consider their ethnicity to be (rather than having it assigned by an intake staff person). Anthropometrics, such as BMI and WC, should have different cutoffs based on a patient's ethnicity. Future research will need to determine whether metrics that gauge glycemic status and cardiovascular risk should be modified based on ethnicity-specific data. This evolved, robust model provides applications to the broad range of HCP involved in diabetes care, patients with diabetes who represent a broad range of ethnicities and cultures who now participate in shared decision-making, and the full complement of stakeholders ranging from governmental and other regulatory agencies, to third-party payers, to industry supplying the necessary tools for prevention and management, to various intermediaries such as corporate human resources departments, to educators, and to researchers. Derivative products from the new model include updated CPGs, CPAs, and checklists as more concrete tools to assist clinical decision-making. This position paper should be viewed as a next step to address diversity among patients with diabetes, hopefully leading to a growing body of pragmatic documents, web-based tools, and experiences that optimize diabetes care for everyone.

Table 10
Core Recommendations for Transculturalizing Diabetes Care in America^a

Recommendation	Model components	Description
1	2,4,5	Define culturally competent descriptors and classifiers (e.g., Latino/Hispanic)
2	4	Begin process of transculturalizing white papers (CPG, CPA, checklists, position papers, etc.) with emphasis on social determinants of health, lifestyle medicine, and pharmaceutical strategies (e.g., prioritizing postprandial > fasting BG for Asian Americans)
3	2,4	Review outpatient setting, identify shortcomings, and start culturally adapting infrastructure: change informational materials, technology, and behaviors (e.g., involve case managers and bilingual care coordinators, and develop structured disease management protocols)
4	4	Assign flexible timing for office hours to accommodate patient with rigid work hours (before 8-9 AM and after 5-6 PM; weekends and holidays)
5	3,4	Learn and practice behavioral medicine, especially motivational interviewing that is culturally adapted for ethnic minorities; other examples including building trust, paying attention to nonverbal communication, learning some foreign language words/phrases, communicating that your patient "matters"
6	1,2	Engage with local, state, and federal governmental agencies to improve culturally competent lifestyle/nutritional messaging and health literacy, reduce food deserts, develop legislation for transculturalized diabetes care and a culturally appropriate built environment
7	2,4	Create community partnerships with HCP to improve preventive care
8	4,5	Develop and use technology to track performance with different populations
9	5,6	Work with relevant agencies to change recruitment and retention strategies for clinical trials to better represent multiculturalism
10	6	Campaign for funding and then design/execute scientific studies to determine epigenetic mechanisms linking cultural factors, the epigenome, and disease expression

Abbreviations: BG = blood glucose; CPA = clinical practice algorithm; CPG = clinical practice guideline; HCP = health care professional(s).
^aSee Figure 5 for AACE Transcultural Diabetes Chronic Care Model components.

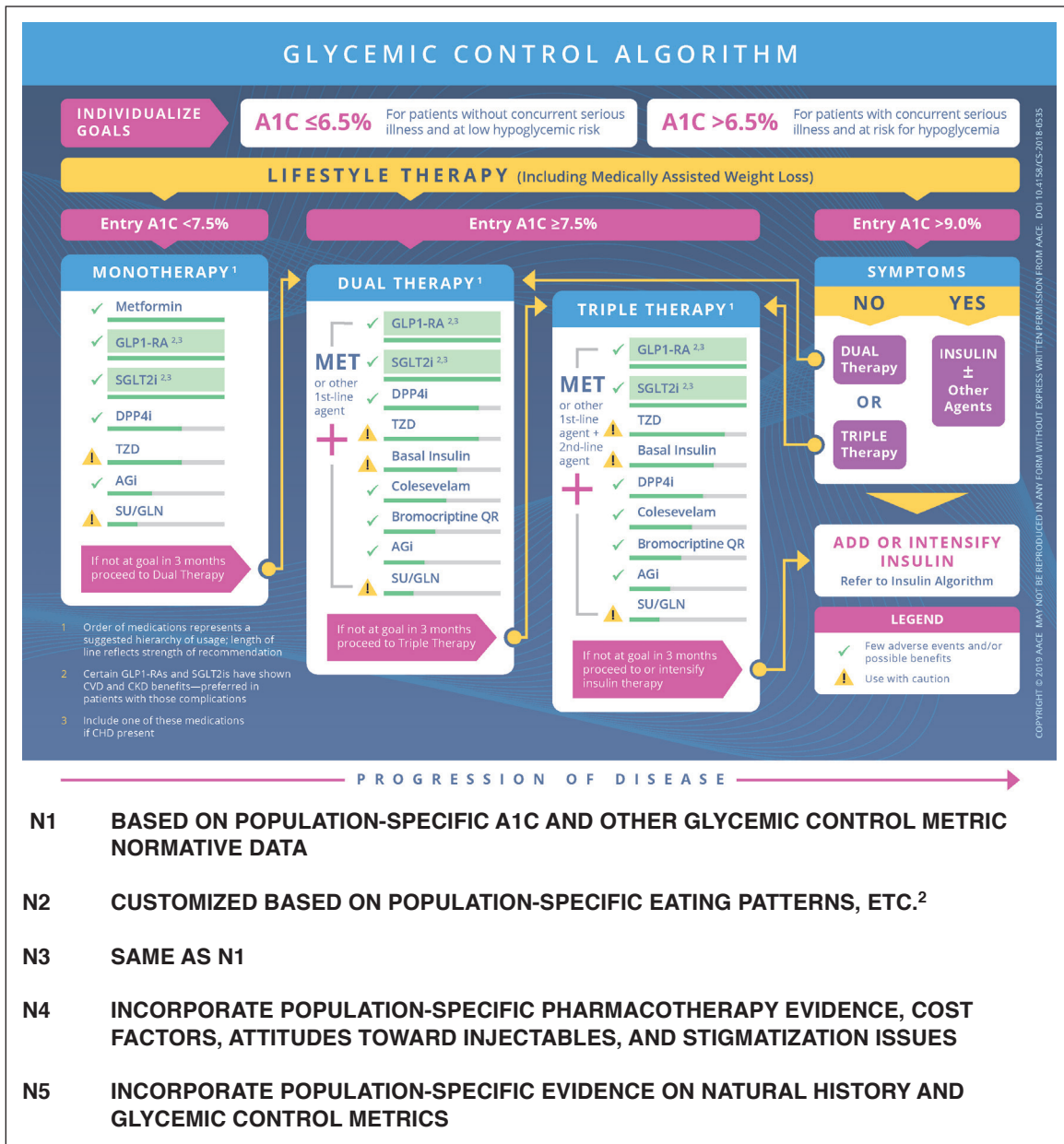


Fig. 4. Transculturalization of the 2019 American Association of Clinical Endocrinologists/American College of Endocrinology comprehensive type 2 diabetes management algorithm.*

1. Abbreviations and details provided in reference (310).
2. N1 ... N5 are hierarchical node levels provided in the Figure 1 algorithm template.
3. Structured lifestyle changes targeted by transculturalization include population- and cultural-specific eating patterns, attitudes toward and types of physical activity, causes and ways to reduce stress, belief systems toward health and health care professionals, and tobacco use.

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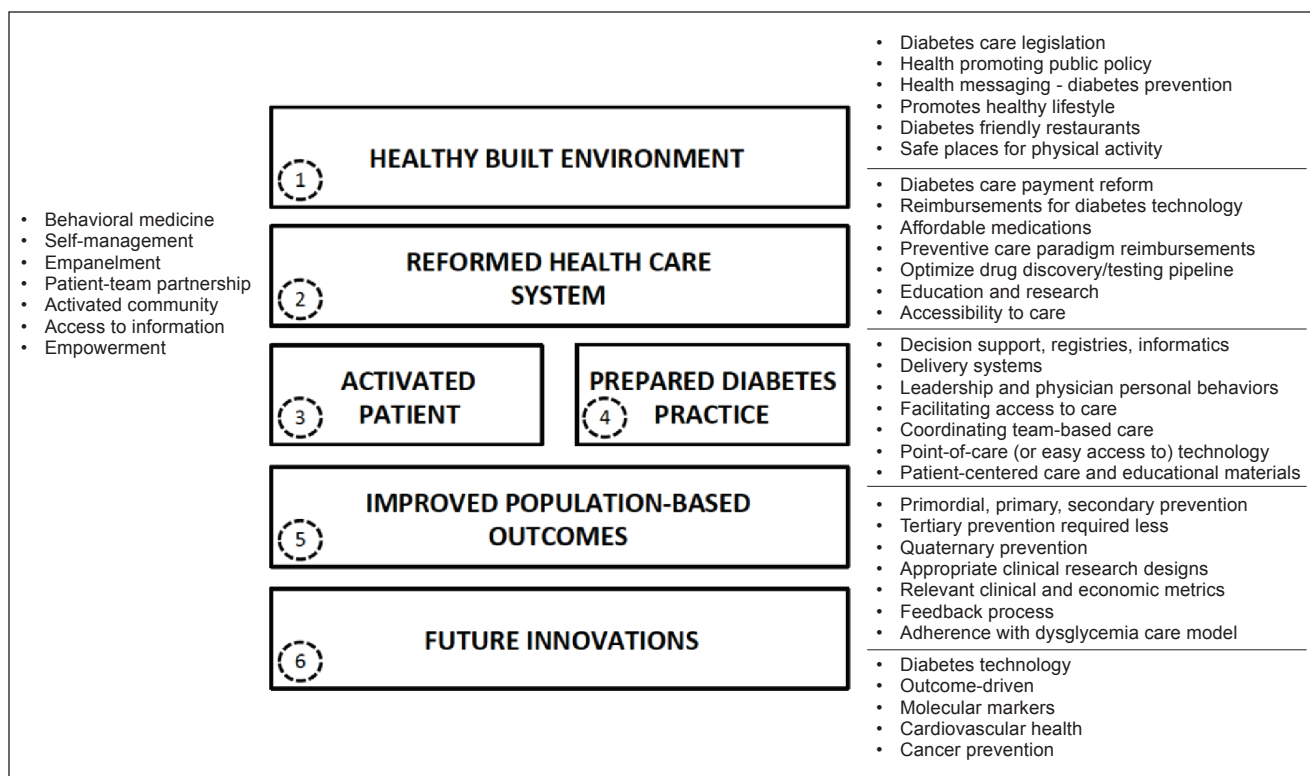


Fig. 5. American Association of Clinical Endocrinologists (AACE) transcultural diabetes chronic care model.*

Each component of the AACE diabetes chronic care model is transculturalized and detailed in Table 10:

1. Concerted efforts at local, state, and federal government levels to culturally adapt nutritional messaging, accessible and safe recreational areas for physical activity in underserved areas, public service announcements that target ethnic minorities, research funding to engage more ethnic minorities;
2. Defining an emphasis on behavioral medicine and other aspects of lifestyle medicine, shaping policy for reimbursement structures that can apply to ethnic minorities, particularly those in lower socio-economic classes, and development of technologies that facilitate culturally adapted prompts and nudges for better adherence with advice from health care professionals;
3. Implementing formal education and then routine behavioral medicine techniques, especially with tutorials and mentorship in culturally adapted motivational interviewing, restructuring routine encounters that shifts time from computer screens to face-to-face patient contact to motivate patients to adopt beneficial lifestyle change and adherence with medications;
4. Creating an office infrastructure with culturally appropriate written and web-based materials, translators as needed, diabetes technology instruction and economic assistance, and fully trained staff at every level of human touch; all patients asked what they consider their ethnicity to be;
5. Prevention and treatment protocols with a registry and ability to monitor performance in aggregate, but also based on individual ethno-cultural classifiers; and
6. Involvement of all stakeholders to incorporate cultural diversity and precision medicine that applies equally to all ethnicities and cultures, in the development of new technologies, research, educational models, social structures and politics, and clinical practice.

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GLOSSARY

Acculturation	At an individual level, the process of a foreign-born person adopting the social and behavioral attributes of the dominant host culture
Adiposity-based chronic disease	ABCD: new diagnostic term based on amount, distribution, and function of adipose tissue and/or intracellular fat (contrasted with “obesity,” which is defined only in terms of body mass index, or the amount of adipose tissue)
African American	American descended from people with African ancestry, generally from those who were enslaved
African immigrant	People of sub-Saharan ancestry
African-Caribbean immigrant	Person of African descent, migrated from the Caribbean
Asian American	American descended from people with Asian ancestry

Continued on next page.

GLOSSARY *Continued*

Black American	An inclusive term that incorporates culture and can generally describe any “person of color” but more specifically refers to African Americans
Built environment	Human-made surroundings in which people live
Caucasian	People with light skin pigmentation generally European descent (also referred to as “White” or “Europid”)
Counter-conditioning	Technique that incorporates positive actions/responses to convert unwanted (unhealthy) behaviors into wanted (healthy) behaviors
Cultural competency	Ability of health care professionals and organizations to meet the cultural needs of the patient
Cultural consonance	Extent to which health care professionals and organizations behave in a manner that is appropriate for a patient’s culture
Culture	At a population level, a clustering of nonphysical human attributes; on an individual level, a way of life that may be described in terms of population behavior
Dramatic relief	Emotional arousal that accompanies hope for changing from unhealthy to healthy behaviors
Dysglycemia-Based Chronic Disease	DBCD: new diagnostic term based on a spectrum from insulin resistance, to prediabetes, to T2D, to T2D with CVD (contrasted with T2D or prediabetes existing in isolation and not part of this continuum)
Ethnicity	A group of people whose members identify with each other, through common heritage and ancestry, and often common language, culture, and ideology
Food desert	Geographic area, generally populated by low-income residents, in which access to affordable, good-quality food (e.g., fresh fruits and vegetables) is difficult
Food insecurity	Consequence of living in an environment with limited access to food (specifically, affordable and/or nutritious food)
Genome-wide association study	Explorative/observational study of associations between gene variants and traits
Hispanic	A U.S. census demographic term for Spanish-speaking people (e.g., from Latin American, but not Brazil, and including Spain)
Internal oppression	Self-image that incorporates societal myths and misinformation associated with discrimination and cruelty
Latino	People from Latin America (i.e., including Brazil but not including Spain)
Latino/Hispanic	Preferred term incorporating features of both Latino and Hispanic designations
Lifestyle	A person’s manner of living within a particular environmental setting
Lifestyle medicine	The nonpharmacologic and nonprocedural management of chronic disease
Meme	Cultural analog to a gene: idea or behavior that is transmitted from person to person within a specific culture
Native American	From indigenous peoples of the United States, Native Hawaiians, and some Alaskan natives
Non-Hispanic black	A U.S. census demographic term for people with dark skin but who are not Hispanic
Non-Hispanic white	A U.S. census demographic term for people with light skin but who are not Hispanic
Pulses	Healthy foods prominent in many ethnic eating patterns representing seeds of plants in the legume family, including beans, peas, and lentils
Race	A local geographic or global human population distinguished by a distinct group of genetically transmitted physical characteristics; not defined scientifically or anthropologically but rather by self-identification; may therefore take into account social, cultural, and ancestral qualities
Trans-ancestry	Term generally applied to genome-wide meta-analyses across multiple ethnic groups to better characterize genetic architecture for susceptibility without bias toward a particular ancestry
Transcultural	Term generally applied to gaining knowledge about how diseases are expressed and managed in different cultures, and more specifically, about adapting (or transculturalizing) evidence-based clinical recommendations from a source to a target population
White paper	An authoritative document from a professional organization on a particular topic; in medicine, this includes position papers, consensus statements, conference proceedings, and clinical practice guidelines, algorithms, and checklists

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