



Acculturation and Diet Among Chinese American Immigrants in New York City

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ABSTRACT

Background: There are limited data on the social and cultural determinants of dietary intake in Chinese Americans. Over 560,000 New York City residents are Chinese American, and there has been a growing trend over the past 30 y of permanent migration from China to the USA.

Objective: The purpose of this secondary data analysis is to describe associations between diet, measured by self-report, and diet quality, with level of acculturation in a cross-sectional sample of urban-dwelling Chinese American immigrants.

Methods: This was a cross-sectional study involving 2071 foreign-born Chinese American adults. Acculturation was assessed using the Stephenson Multigroup Acculturation Scale, diet using a Chinese-adapted FFQ, and diet quality using the Alternative Healthy Eating Index (AHEI). Multivariable regression was used to assess associations between ethnic (ESI; Chinese) and dominant (DSI; American) society immersion scores with self-reported dietary measures.

Results: No significant associations were found between acculturation and overall AHEI score. Higher ESI and DSI scores were associated with higher vegetable, fruit, and nut/legume scores; a higher DSI score only was associated with higher whole grain and PUFA scores. A 1-unit increase in the ESI score was associated with a 0.005 ($P = 0.009$) lower red and processed meat component score, whereas a 1-unit increase in DSI score was associated with a 0.01 ($P = 0.025$) higher red and processed meat component score.

Conclusions: Assessment of acculturation level may help to tailor dietary strategies that are appropriate to what Chinese American immigrant communities are consuming to more effectively decrease the risk of chronic disease. *Curr Dev Nutr* 2019;4:nzz124.

Keywords: diet quality, Chinese Americans, acculturation, urban health, dietary acculturation

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Abbreviations used: AHEI, Alternative Healthy Eating Index; CCPH, Chinese Community Partnership for Health; CHA CHA, Chinese American Cardiovascular Health Assessment; DSI, dominant society immersion; ESI, ethnic society immersion; NYC, New York City; SMAS, Stephenson Multigroup Acculturation Scale.

Introduction

There are limited data on the social and cultural determinants of dietary intake in Chinese Americans. Data from the American Community Survey of the USA Census indicate that Chinese immigrants are the third-largest foreign-born group in the USA, after Mexicans and Indians. Among adults living in New York City (NYC), Chinese Americans currently represent 6.6% of the total population (over 560,000 NYC residents) with only 10% born in the USA (1). With the growing trend over the past 30 y of permanent migration from China to NYC (2), and elsewhere in the USA, and the aging of the initial waves of Chinese American immigrants, who arrived in 1965, it is vital to examine the health and cultural impact of living in the USA on Chinese immigrants.

Acculturation, the process by which a person raised in one culture comes into contact with a second culture, may have an important

influence on diet. However, most existing literature uses crude markers of acculturation (e.g., length of time in the USA, language spoken at home) which may not fully capture important dimensions of acculturation. There is wide variability in acculturation in terms of speaking, reading, and written language preferences, keeping up-to-date on native and/or American affairs and history, food eaten both inside and out of the home, and feeling accepted in the USA, which are factors that can potentially impact a person's health, access to foods, and quality of life. Several studies have explored cross-sectional differences in diet and lifestyle by current country or city of residence (3, 4), and some have additionally included crude measures of acculturation (5–7). More recently, calculated, multi-item scales have been used in place of the previously mentioned single-component acculturation scales to capture a larger view of the acculturation process and its relation to diet among various Asian American subgroups, not including Chinese Americans

(8–10). Only 1 study has used a multi-item acculturation scale in combination with a dietary assessment in a population of Chinese Americans, but this did not include men (11).

The Healthy Eating Index (HEI) was created to measure adherence to the Dietary Guidelines for Americans (12). The modified Alternative Healthy Eating Index (AHEI-2010) measures diet by characterizing foods and nutrients consumed that are associated with chronic diseases in diverse populations (13, 14). For example, fruit juice is excluded from the fruit component in AHEI-2010 because it is not associated with a lower risk of cardiovascular disease, but is included in the sugar-sweetened beverage and fruit juice component because it is positively associated with the risk of diabetes (15). The grouping of these components allows the scoring method to better reflect a higher total score for foods inversely associated with the risk of major chronic diseases including cardiovascular disease and diabetes. However, the AHEI-2010 has not yet been used to characterize diets among Chinese American immigrants.

The purpose of this secondary data analysis is to describe associations between diet, measured by self-report, and diet quality, with level of acculturation in a cross-sectional sample of urban-dwelling Chinese American immigrants. This analysis adds to the existing published literature by including both men and women who immigrated from China, lived in NYC at the time of data collection, and completed a multi-component, validated acculturation questionnaire, a Chinese-adapted dietary assessment.

Methods

Participants

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

The study protocol was approved by the Institutional Review Boards at the Albert Einstein College of Medicine and the New York-Downtown Hospital. Informed consent was obtained from all participants included in this study.

Data for this analysis were from the Chinese American Cardiovascular Health Assessment (CHA CHA) 2010–11. As previously described (16–19), the CHA CHA study was a cross-sectional survey ($n = 2071$) of foreign-born Chinese American adult New Yorkers conducted by researchers at the Albert Einstein College of Medicine, in collaboration with New York-Downtown Hospital and the Chinese Community Partnership for Health (CCPH). Eligibility criteria for participation were: 1) Chinese ethnicity; 2) aged ≥ 35 y; 3) born in mainland China; and 4) provided informed consent.

Data collection

Participants were recruited by CCPH to take part in a community cardiovascular screening initiative. The CCPH disseminated information about the screening program through Chinese language media, as well as senior centers and businesses located in the Chinese communities in lower Manhattan and Sunset Park, Brooklyn. The CCPH staff scheduled appointments that took place at New York-Downtown Hospital's Manhattan and Brooklyn ambulatory care sites. During the scheduled

clinic appointments, trained CCPH staff obtained fasting blood and anthropometric measures, and collected participants' sociodemographic and behavioral information. All survey instruments were presented in English with a Chinese translation shown underneath each question.

Measures

Acculturation.

Acculturation was assessed using the Stephenson Multigroup Acculturation Scale (SMAS) (20). The SMAS is a 32-item scale that asks about various aspects of life, including language, social characteristics (e.g., food and music preferences, ethnicity of friends), and political preferences. Two dimensions of acculturation may be calculated from the SMAS: ethnic society immersion (ESI) and dominant society immersion (DSI). The first dimension, ESI, is a marker of how closely the individual identifies with the culture of their 'native country' or 'country of origin' (i.e., Chinese society). The second dimension, DSI, is a marker of how closely the individual identifies with the culture of their host country (i.e., American society) – in this case the respondents rate their responses to these items on a scale of 1 to 4 (false, partly false, partly true, or true). ESI and DSI scores are inversely, weakly correlated ($\rho = -0.11$, $P < 0.001$) (18). To estimate ESI, the responses to the first 17 items of the SMAS are summed and an average across responses is calculated, with a maximum total score of 4. To estimate DSI, the responses to items 18 to 32 of the SMAS are summed and an average across responses is calculated, also with a maximum total score of 4. A higher score on either dimension indicated a higher personal identification with respective societies.

Dietary assessment.

Diet was measured using a 96-item Chinese-modified FFQ adapted for Chinese Americans (21). Participants were asked to report how often, and in what usual quantity, they had consumed the listed food items over the past year. Pictures were provided to aid estimation of portion size. Each food item was converted to servings per day.

Diet quality was calculated using the AHEI-2010, where a higher score indicates better adherence to the dietary guidelines and a lower possible risk of chronic disease (22–25). This index is made up of 11 components with a possible calculated total ranging from 0 to 110 (Table 1). Each AHEI component is given a score ranging from 0 to 10. A higher component score is given with a higher intake of vegetables, fruits, whole grains, nuts and legumes, EPA + DHA, and PUFAs and lower intake of sugar-sweetened beverages, red and processed meat, and sodium. A score of 0 is given when participants report drinking 2.5 and 3.5 or more alcoholic drinks per day, a score of 2.5 for <0.5 or 1.5–2.4, a score of 1 for <0.5 or 2.0–3.4, and a score of 10 for 0.5–1.5 and 0.5–2.0 for women and men, respectively.

Analysis

Demographic characteristics were summarized using descriptive statistics for the entire sample and the biomarker subsample. Alternative BMI cut points for Asian populations were used: 18.5 to <23.0 kg/m² being normal, ≥ 23 to <27.5 being overweight, and ≥ 27.5 being obese (26). Spearman correlations were used to compare both biomarker and FFQ data with ESI and DSI.

The AHEI scoring criteria were adapted from Cheung et al. (23). *Trans* fats were excluded due to lack of data; therefore, the AHEI was

TABLE 1 Alternative Healthy Eating Index scoring components for the Chinese American Cardiovascular Health Assessment

Category	CHA CHA measures ¹	Criteria ²							
		for minimum score (0)	for maximum score (10)						
Vegetables, servings/d • Does not include potatoes, French fries	Broccoli, or Chinese broccoli	0	≥5						
	Cauliflower								
	Cabbage or Napa cabbage								
	Dark green, leafy vegetables such as bok choy, spinach, or mustard greens								
	Beans or peas, such as green beans, snow peas, or green peas								
	Eggplant or squashes, such as winter melon, bitter melon, or zucchini								
	Carrots, raw or cooked								
	Corn, fresh, frozen, or canned								
	Celery								
	Bell peppers								
	Asparagus								
	Tomatoes								
	Bean sprouts								
	Turnips or radish								
Fruit, servings/d	Preserved vegetables, such as preserved Chinese mustard greens or preserved radish	0	≥4						
	Tossed salad								
	Scallions or onions								
	Apples or pears								
	Bananas								
	Oranges or tangerines								
	Grapefruit								
	Grapes								
	Fresh peaches or plums, in season								
	Papaya or mango, in season								
	Cantaloupe, in season								
	Watermelon, in season								
	Whole grains, g/d			Cold breakfast cereals with milk	0	Women: 75; Men: 90			
				• When you eat cereal, how often is it high-fiber or bran cereal?					
Cooked cereals, like oatmeal									
Bread, including in sandwiches or hamburgers									
• When you have bread, how often do you have dark bread, like whole wheat or rye?									
Fiber FFQ variable									
Sugar-sweetened beverages and fruit juice, servings/d		100% orange or grapefruit juice	≥1	0					
		Other fruit juices, like apple or grape juice							
		Coffee							
		• How often do you add sugar?							
		Tea							
		• How often do you add sugar?							
		Soda, such as Coca-Cola and 7-Up							
		Nuts, legumes, and vegetable protein, servings/d					Soy milk	0	≥1
	Tofu, including soft, dried, and fried								
	Peanuts or other nuts or seeds								
	Peanut butter on bread or vegetables								
	Red/processed meat, servings/d				Beef, roasted, broiled, or barbecued, including steak, roast beef, and hamburger	≥1.5	0		
					Beef, in stew or in soup				
					Beef, stir-fried				
Beef meatballs									
Pork, roasted, broiled, or barbecued, such as pork chops, roast pork, or barbecued pork									
Pork, steamed in stew, or in soup									
Pork, stir-fried									
Spareribs									
Steamed or boiled dumplings									
Sandwiches with ham, bacon, or sausage									
Trans fat, % of energy			≥4	≤0.5					
		Long-chain (n-3) fats (EPA + DHA), mg/d	0	250					
PUFA, % of energy		DHA	≤2	≥10					
		EPA							
Sodium, mg/d	Polyunsaturated fat FFQ variable	Highest decile	Lowest decile						
	Sodium FFQ variable								
Alcohol, drinks/d	Beer	Women: ≥2.5;	Women: 0.5–1.5;						
	Wine	Men: ≥3.5	Men: 0.5–2.0						
	Liquor								
	Alcohol FFQ variable								

¹CHA CHA, The Chinese American Cardiovascular Health Assessment.

²Overall score is derived by summing the scores for each of the items consumed in each category (Vegetables, Fruit, etc.)

scored from 0 to 100 instead of 0 to 110. Spearman correlations were used for the total score and each component to compare the associations with ESI and DSI. In multivariable regression, variables were adjusted

for age, sex, household income, and education. Data were analyzed using SPSS (IBM Corp., released 2015; IBM SPSS Statistics for Windows, Version 23.0).

TABLE 2 Demographic characteristics of study participants; The Chinese American Cardiovascular Health Assessment study 2010–11

	Overall n (%)
Age, y (mean ± SD)	2071 (100) 52.7 ± 13.8
Age group, y	
21–44	558 (26.9)
45–64	1093 (52.8)
65–84	408 (16.7)
85+	13 (0.6)
Female sex	1093 (52.8)
BMI, mean ± SD	23.9 ± 3.2
<23.0	810 (39.1)
23.0–27.49	996 (48.1)
≥27.5	623 (30.1)
Years living in the USA, mean ± SD	13 ± 10
Education	
No school	26 (1.3)
Elementary school	287 (13.9)
High school	1060 (51.2)
College graduate	699 (33.7)
Current household income/year	
\$0–9999	689 (33.3)
\$10,000–19,999	621 (30.0)
\$20,000–29,999	354 (17.1)
\$30,000–49,999	236 (11.4)
\$50,000+	172 (8.3)
Primary language spoken at home	
Chinese	1813 (87.5)
English	10 (0.5)
Both	248 (12.0)
Acculturation, ¹ mean ± SD	
Ethnic society immersion	3.64 ± 0.25
Dominant society immersion	2.22 ± 0.59

¹Assessed by the Stephenson Multigroup Acculturation Scale (SMAS); total possible scores of 4 for ethnic or dominant society immersion.

Results

Participants reported immigrating to the USA between 1935 and 2009, and the most common year was 2000. The mean age of the CHA CHA participants was 52.7 ± 12.8 y, slightly more than half were female (52.8%), and mean BMI was 23.9 (Table 2). One-third of study participants had graduated from college (33.7%), 51.2% had completed high school only, 12.9% had completed up to elementary school, and 1.3% had not attended school. When asked about household family yearly income, most (33%) reported earning \$0–9999 or \$10,000–\$19,999 (30%) per year. The primary language spoken at home was Chinese among 87.5% of the study participants, both Chinese and English among 12%, and primarily English among 0.5%. The mean ESI and DSI scores were 3.64 and 2.22, respectively, indicating overall, a higher identification with Chinese compared with American culture (less acculturated sample).

The mean ± SD AHEI score was 46.5 ± 8.2 and, in order of highest component scores, were sugar-sweetened beverages and fruit juice, EPA + DHA, PUFAs, vegetables, sodium, nuts and legumes, fruits, red and processed meat, alcohol, and whole grains (Table 3). The sodium score was inversely associated with ESI ($r = -0.05$, $P = 0.014$) and

the sugar-sweetened beverage score was inversely associated with DSI ($r = -0.20$, $P < 0.001$).

In multivariable analysis, an overall AHEI score was not associated with ESI or DSI ($P > 0.05$) (Table 4). A 1-unit increase in the ESI score was associated with a 0.005 ($P = 0.009$) lower red and processed meat component score, whereas a 1-unit increase in the DSI score was associated with a 0.01 ($P = 0.025$) higher red and processed meat component score.

In adjusted models, a 1-unit increase in the DSI score was associated with a higher whole grain ($\beta = 0.066$, $P < 0.001$), red and processed meat ($\beta = 0.010$, $P = 0.025$), and PUFA ($\beta = 0.040$, $P < 0.001$) component score and a lower sugar-sweetened beverage ($\beta = -0.024$, $P < 0.001$) and nut and legume ($\beta = -0.014$, $P = 0.004$) component score.

Discussion

In this secondary data analysis of Chinese American immigrants, we assessed affiliation with both Chinese and American culture and their relations to dietary intake. When looking at diet characterized by AHEI diet quality standards, the healthiest food behavior was lower consumption of sugar-sweetened beverages (mean score 6.8 out of 10) whereas low whole grain intake (mean score 1.5 out of 10) provides the greatest opportunity for improvement. A higher sodium score, indicating a lower overall consumption, was significantly associated with a lower ESI score, and a higher sugar-sweetened beverage and fruit juice score, also indicating a lower overall consumption, was significantly associated with a lower DSI score. In multivariable regression, a lower ESI score was associated with a higher AHEI component score of red and processed meat, indicating a higher intake of beef and pork. A higher DSI score was associated with a higher whole grain score, red and processed meat score and PUFA score, indicating higher consumption of oatmeal and whole grain bread, lower beef and pork, and higher overall PUFA intake. A higher DSI was also associated with decreased sugar-sweetened beverage and nut and legume component scores, indicating higher soda, orange juice, and fruit juice, and lower tofu, nuts, and peanut butter intake. These results suggest that greater affiliation with American culture or Chinese culture has an influence on foods frequently consumed among the sampled Chinese American immigrant population living in NYC.

The findings of this analysis are similar to a series of studies among Chinese American adults living in Philadelphia. The first study used 3 items to measure acculturation (length of residency in the USA, English proficiency, and number of congenial American friends) and measured diet by general food habits and an FFQ (27). The second and third studies included only women, measured acculturation by a 37-item questionnaire (English language use and proficiency; affiliation with American people; participation in American activities; pride in American culture; preference for English language media; and preference for American food), and assessed diet by the Diet Quality Index-International measuring dietary moderation (6, 11). In the cross-sectional study, acculturation was significantly associated with improved dietary variety (OR: 2.4; 95% CI: 1.5–3.8) and adequacy (OR: 1.6; 95% CI: 1.0–2.6) and lower dietary moderation among women with less than a high school education (6). In the longitudinal study, an increase in acculturation was associated with an increase in servings per

TABLE 3 Alternative Healthy Eating Index scores and correlation with acculturation¹

	Intake Median (IQR)	Overall score Mean ± SD	Correlation	
			Correlation with ESI	Correlation with DSI
Overall score		46.5 ± 8.2	0.03 (0.133)	0.04 (0.108)
Components				
Vegetables, servings/d	2.3 (1.6–3.3)	5.1 ± 2.2	0.08 (0.001)*	0.08 (0.000)*
Fruits, servings/d	1.4 (0.9–2.2)	4.3 ± 2.1	0.04 (0.043)*	0.07 (0.003)*
Whole grains, g/d	2.4 (0.0–9.2)	1.5 ± 1.0	0.04 (0.094)	0.17 (0.000)*
Sugar-sweetened beverages, servings/d	0.1 (0.0–0.5)	6.8 ± 3.4	–0.01 (0.635)	–0.20 (0.000)*
Nuts and legumes, servings/d	0.4 (0.2–0.7)	4.9 ± 3.1	0.05 (0.015)*	0.08 (0.000)*
Red/processed meat, servings/d	1.0 (0.6–1.6)	3.6 ± 2.9	–0.04 (0.094)	–0.00 (0.965)
Long-chain fats (EPA + DHA), mg/d	155.9 (93.2–256.0)	6.3 ± 2.8	–0.00 (0.970)	0.02 (0.357)
PUFA, % of energy	6.8 (5.5–8.2)	6.0 ± 2.0	0.04 (0.060)	0.14 (0.000)*
Sodium, mg/d	3456.4 (2617.7–4516.6)	5.0 ± 3.4	–0.05 (0.014)*	–0.03 (0.198)
Alcohol, drinks/d	0.0 (0.0–0.7)	3.1 ± 2.0	0.01 (0.686)	–0.04 (0.108)

¹*indicates statistical significance at $P < 0.05$. DSI, dominant society immersion; ESI, ethnic society immersion.

day of beef, dairy, and bread, and a decrease in flour/rice and dark green vegetables which is similar to the findings of the present analysis (11).

Among older Chinese Americans living in NYC, Wong and colleagues measured acculturation by birthplace and length of residence in the USA and used 3 24-h recall dietary assessments (28). Interestingly, there was a significant difference in overall dairy intake by birthplace; people originally from Northern China consumed ~0.9 servings per day and people originally from Southern China and those from Hong Kong both consumed ~0.5 servings per day. However average servings of all food groups did not differ significantly between living 0–9 y, 10–19 y, 20–29 y, or >30 y in the USA. All of the members of this study were recruited at health fairs which may influence the generalizability of the results.

Additional studies have published findings among other Asian American subgroups. First-generation Filipino adults living in California reported eating increased amounts of beef, pork, chicken,

fresh fruits and vegetables, commercially prepared cereals and bakery products, and dairy products and decreased amounts of fresh seafood and organ meats after moving to the USA (8). South Korean immigrants living in NYC, dichotomized by low or high acculturation, reported eating a higher frequency per day of: 1) broccoli, peas, and corn, 2) corn chips, popcorn, crackers, 3) doughnuts, pastries, cake, cookies, doughnuts, candy, and 4) fiber cereals among the high acculturation group (9). Although snack, desserts, and fiber cereal are similar, the associations of vegetable items and/or ESI or DSI are mixed. Some food changes may be specific to Chinese Americans and some may be generalizable changes among multiple Asian American subgroups such as various preparations of pork and fresh vegetables.

Qualitative studies of Chinese and American undergraduate students, parents, and women examining food behaviors all mentioned that breakfast items associated with American culture are more likely to be consumed than lunch or dinner foods associated with American

TABLE 4 Multivariable regression results: diet quality associated with 1-unit increase in acculturation within the Chinese American Cardiovascular Health Assessment study¹

	Ethnic society immersion			Dominant society immersion		
	β coefficient	95% CI	P value	β coefficient	95% CI	P value
Overall score	0.000	(–0.002, 0.001)	0.601	0.003	(0.000, 0.006)	0.087
By components						
Vegetables	0.001	(–0.005, 0.008)	0.662	0.007	(–0.006, 0.020)	0.286
Fruits	0.002	(–0.004, 0.007)	0.488	0.009	(–0.003, 0.021)	0.138
Whole grains	–0.004	(–0.015, 0.007)	0.460	0.066	(0.043, 0.089)	<0.001*
Sugar-sweetened beverages	0.000	(–0.003, 0.003)	0.942	–0.024	(–0.031, –0.017)	<0.001*
Nuts and legumes	0.001	(–0.003, 0.005)	0.658	–0.014	(–0.023, –0.004)	0.004*
Red/processed meat	–0.005	(–0.009, –0.001)	0.009*	0.010	(0.001, 0.018)	0.025*
Long-chain fats (EPA + DHA)	0.000	(–0.005, 0.005)	0.902	–0.003	(–0.013, 0.008)	0.614
PUFA	–0.001	(–0.007, 0.006)	0.819	0.040	(0.025, 0.054)	<0.001*
Sodium	–0.002	(–0.006, 0.003)	0.500	0.002	(–0.007, 0.012)	0.618
Alcohol	0.001	(–0.005, 0.006)	0.829	–0.007	(–0.019, 0.005)	0.235

Models adjusted for age, sex, household income, and education.

¹*indicates statistical significance at $P < 0.05$.

culture (7, 29, 30). Whole grains, such as oatmeal or whole grain breads, also scored the lowest of the AHEI components (1.5 out of 10), meaning it was the furthest away from dietary recommendations intended for ideal health. Understanding the influences of acculturation on change in food intake of mostly energy-dense typical breakfast foods may be valuable when planning an intervention to improve overall diet quality in the population group.

Compared to adults with type 2 diabetes living in China, the CHA CHA participants had slightly higher AHEI component scores for vegetables, fruits, red and processed meat, and alcohol and much lower whole grain, nut and legume, EPA + DHA, and PUFA component scores (23). Results were more similar to results for the US-based Nurses' Health Study and Health Professionals Follow-Up Study results (22), other than slightly higher fruit, sugar-sweetened beverage and lower alcohol component scores.

The results of this study are not generalizable to all Chinese Americans living in NY state or the USA, but this information can facilitate serving the large number of permanent American citizens immigrating from China to NYC. Since the data collected were cross-sectional, temporality in the associations between acculturation and food intake cannot be described. In addition, many of the correlations between ESI and DSI and individual foods and AHEI component scores were weak (r ranging from -0.20 to 0.32), but significant. The FFQ was validated in a Chinese immigrant population; however, individual AHEI components such as DHA and EPA have not been previously evaluated. Furthermore, the strength of the correlations between acculturation scores and AHEI components was <0.2 , suggesting many other factors influence diet quality among Chinese immigrants.

In this data analysis, AHEI scores more closely aligned with a US-based sample than a Chinese-based sample and an increase in DSI was associated with small, but healthier whole grain, red meat, and PUFA scores and less healthy sugar-sweetened beverage and nut and legume scores. This work helps to uncover the role of acculturation on diet in an urban community of Chinese American immigrants. Understanding the similarities and differences to other ethnic groups may be valuable to develop ethnic-specific dietary and lifestyle interventions to decrease the risk of chronic disease.

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