

**Comparing Disease Burden of Diabetes Mellitus Type 2
between Hmong and other Ethnic Groups**

by

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Abstract

The Hmong, an ethnic group in Laos, immigrated to the United States at the end of the Vietnam War.⁷ Minnesota and California have the largest Hmong populations.⁹ Hmong were historically farmers and hunter-gatherers with inadequate food supply in Laos. Here in America, with a surplus of food and a sedentary lifestyle, the Hmong are at increased risk for diabetes, hence the Thrifty Gene Hypothesis.^{3,4,6,11} This retrospective study compares the prevalence and control of diabetes mellitus-type 2 between the Hmong and other ethnic and racial groups at the Health And Life Organization (HALO) clinic in Sacramento, California. A total of 9,285 charts were reviewed. The Hmong had the highest prevalence but poorest control of diabetes mellitus when compared with the Laotian, Vietnamese, Blacks, Whites, and Hispanics (chi-square p-value <.0001 for difference in prevalence and control). This paper calls for future studies to explore barriers to management and modifiable risk factors among Hmong diabetic patients.

Key Words: The Hmong, Diabetes mellitus, diabetes prevalence, diabetes management

Introduction

Diabetes mellitus (diabetes) is the seventh leading cause of death in the United States (U.S.).¹ Asians have a higher prevalence of diabetes than non-Hispanic Whites.¹ One study found that the Hmong, an immigrant group from Southeast Asia, were three times more likely to have diabetes than non-Hispanic Whites.² Diabetes is rare among the Hmong in Southeast Asia, with a prevalence of 1.4% and 3.7% for the Hmong in Thailand and Vietnam, respectively as compared to 19% for the U.S. Hmong.² Diet, lifestyle, and their interactions with biological factors (as pointed to in the “Thrifty Gene Hypothesis”) predispose the Hmong, like many other immigrants, to diabetes.^{3,4,5,6}

The Hmong are an ethnic group native to Southeast Asia (Laos, Vietnam, and Thailand).⁷ During the U.S. involvement in the Vietnam War (1955–1975), the Hmong in Laos were recruited by the Central Intelligence Agency (CIA) to fight the North Vietnamese Army in Laos.⁷ When the war was over, thousands of the Hmong immigrated to the U.S. between 1980s-2000s.⁷ The Hmong are one of the fastest growing immigrant groups in the U.S. Between 1990 and 2010, the U.S. Hmong population grew by 175%, from 94,439 in 1990 to 260,073 in 2010.^{8,9} The three states with the largest populations of Hmong are California, Minnesota, and Wisconsin.⁹ In California, Sacramento has the second largest Hmong population (~27,000).⁹

Given its exponential population growth and high diabetes prevalence, the U.S. Hmong is facing an ever growing endemic. This means that the U.S. Hmong are at high risk for morbidities and mortalities as diabetes was the seventh leading cause of death and a major risk factor for cardiovascular diseases.¹ Despite these health implications, there are relatively few studies that explore the current disease burden of diabetes in the Hmong. The study conducted by Thao et al was more than five years old, and it only compared diabetes prevalence between the Hmong and non-Hispanic Whites.² Currently, there are no studies that compare the disease burden of the Hmong to other non-Hispanic and non-White ethnic groups. In this study, we attempted to 1) establish the current prevalence of diabetes mellitus type 2 (DM2) in the Hmong, 2) compare the prevalence of diabetes in the Hmong with other immigrants (Laotian, Vietnamese, Hispanics) and their counterparts (Blacks, Whites), and 3) quantify the disease burden by comparing how well diabetes is controlled between the Hmong and the aforementioned groups in Sacramento, California.

Methods

This retrospective study was approved by the Institutional Review Board at the University of California-Davis. We conducted our study at the Health And Life Organization clinic (HALO), a Federally Qualified Health Center founded in 2004 that serves patients of immigrants, low-income, and minority stature.¹⁰ A total of 9,285 charts were reviewed.

Measurement periods were from June 1, 2015 through June 1, 2017. Query captured race (Asian, Non-Hispanic and Hispanic), ethnicity (Hmong, Laotians, Vietnamese, Whites, Hispanics, and Blacks), primary language (Hmong, Laos, Vietnamese, English, and Spanish), age (40-80 years of age), ICD-9 and ICD-10 codes for diabetes mellitus type 2, and hemoglobin a1c lab value <7.0%.

All statistical analyses were conducted using Statistical Analysis System (SAS) software, version 9.4 (SAS Institute, Inc., Cary, NC). Statistical significance was assessed at the .05 level (2-sided). Chi Square tests were performed to compute differences in diabetes prevalence and control between groups. The prevalence of diabetes was computed as the proportion of diabetic patients within each group. The Centers for Disease Control and Prevention (CDC) definition of controlled diabetes (a1c < 7.0%) was employed. The control of diabetes was computed as the proportion of patients with a1c <7.0% within each ethnic group. Logistic regression models were performed to compute odds ratio (OR) for diabetes prevalence and diabetes control between racial and ethnic groups. For all analyses, the Hmong was the control group.

Results

Table 1 shows that there is a disproportionately low number of Laotian patients and a high number of White/Caucasian patients. Across all racial/ethnic groups, patients were mostly young adults (<60-year-old) and women.

TABLE 1: DEMOGRAPHICS by Race/Ethnicity

Race/Ethnicity	N	Age				Gender	
		40 - 50	51 - 60	61 - 70	>71	Men	Women
Hmong	1524	291	545	495	193	578	946
Laotian	117	23	31	41	22	67	50
Vietnamese	501	132	189	159	21	179	322
Blacks/AfricanAm ¹	2756	1082	1115	465	94	1264	1492
Whites/Caucasian ¹	3289	1176	1370	642	101	1492	1797
Hispanics/Latino(a)	1098	428	382	215	73	395	703

1= Non-Hispanic/Non-Latino(a). A total of 9,285 patients seen between June 1, 2015 - June 1, 2017. All patients came from HALO EHR filtering.

Table 2 shows that the Hmong had the highest prevalence of diabetes, followed by Laotians, Hispanics, Vietnamese, Blacks, and then Whites. When comparing the risk of diabetes between the Hmong and another racial group, the Hmong were more likely to have diabetes than all the other groups. Specifically, the odds of the Whites, Blacks, Vietnamese, Hispanics, and Laotians having diabetes are 0.40, 0.42, 0.53, 0.72, and 0.88 times as less as those of the Hmong, respectively. This observation was statistically significant for all group comparisons with p-value < 0.05, except for when comparing Hmong to Laotian, which has a p-value > 0.05.

TABLE 2: DIABETES PREVALENCE by RACE/ETHNICITY

Race/Ethnicity	Total No. Patients	Diabetic Patients	Prevalence	95% Confidence Interval (CI)	Odds Ratio (OR)	P-value for Odds Ratio
Hmong	1524	415	27.23%	0.25 - 0.30	1	
Laotian	117	29	24.79%	0.17 - 0.34	0.88	0.566
Vietnamese	501	83	16.57%	0.13 - 0.20	0.53	<0.0001
Black/AfricanAm ¹	2756	376	13.64%	0.12 - 0.15	0.42	<0.0001
White/Caucasian ¹	3289	424	12.89%	0.12 - 0.14	0.40	<0.0001
Hispanic/Latino(a)	1098	233	21.22%	0.19 - 0.24	0.72	0.0004

1= Non-Hispanic/Non-Latino(a). All patients were 40-80 years old, seen between June 1, 2015 - June 1, 2017. All patients came from HALO EHR filtering. Sample size = 9,285. Chi-Square p-value <0.0001 for racial/ethnic difference for DM prevalence. Odds Ratio (OR) were calculated using the Hmong as the control group versus the other racial/ethnic groups.

Table 3 shows that the Hmong had the worst control of their diabetes, followed by Whites, Blacks, Hispanics, Laotians, and then Vietnamese. When comparing how well diabetes was

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controlled between the Hmong and another racial group, the Hmong were less likely to have a controlled diabetes than all the other groups. Specifically, the odds of the Vietnamese, Laotians, Hispanics, Blacks, and Whites having controlled diabetes are 5.27, 2.30, 2.02, 1.77, and 1.52 times as great as those of the Hmong, respectively. This observation was statistically significant for all group comparisons, with a p-value <0.05.

TABLE 3: DIABETES CONTROL by RACE/ETHNICITY

Race/Ethnicity	Diabetic Patients	No. of Controlled DM	Proportion of Controlled DM	95% Confidence Interval (CI)	Odds Ratio (OR)	P-value for Odds Ratio
Hmong	415	132	31.81%	0.27 - 0.37	1	
Laotian	29	15	51.72%	0.33 - 0.71	2.30	0.031
Vietnamese	83	59	71.08%	0.60 - 0.81	5.27	<0.0001
Black/AfricanAm ¹	376	170	45.21%	0.40 - 0.50	1.77	0.0001
White/Caucasian ¹	424	176	41.51%	0.37 - 0.46	1.52	0.0036
Hispanic/Latino(a)	233	113	48.50%	0.42 - 0.55	2.02	<0.0001

¹ = Non-Hispanic/Non-Latino(a). Sample size = 1,560. All patients were 40-80 years old, seen between June 1, 2015 - June 1, 2017. All patients came from HALO EHR filtering. Chi-Square p-value <0.0001 for racial/ethnic difference for DM control. DM "in control" means "ever in control" (at least one A1c lab value at CDC goal of <7.0%). Odds Ratio (OR) were calculated using the Hmong as the control group versus the other racial/ethnic groups.

Conclusions

Based on the Thrifty Gene Hypothesis, the Hmong like other immigrants were at increased risk for metabolic diseases, such as diabetes after they immigrated to the U.S. The shift from a low food surplus and high energy expenditure lifestyle in their native countries to a high food surplus and low energy expenditure lifestyle in the U.S. turns on genes that make immigrants very efficient at converting excess calories into fat.^{3,6,11} The Thrifty Gene Hypothesis states that under the influence of gene regulation, a diet high in carbohydrates and a decrease in physical activity promotes fat deposition and causes diabetes mellitus.^{3,6,11} A change from a high-fiber diet in Laos to high-carbohydrate diet in the U.S. and the continued consumption of white rice may contribute to the high diabetes prevalence among the U.S. Hmong population. White rice, a culturally preferred dish high in carbohydrate content, is the center of every Hmong meal—breakfast, lunch, and dinner.⁴ The shift from an active lifestyle in Laos to a sedentary lifestyle in the U.S. has been associated with a 112% increase in risk of diabetes.⁶

Our findings were consistent with prior studies in showing that there is still a very high disease burden of diabetes mellitus type 2 among the Hmong.^{2,12} The prevalence of diabetes for

the Hmong in our study was 27.23% as compared to the national prevalence of 9.8%, which implies that the Hmong were three times more likely than the average American to have diabetes. Among the six racial and ethnic studied groups, the Hmong were 1.14, 1.39, 1.89, 2.34, and 2.5 times as likely to have diabetes than the Laotian, Hispanics, Vietnamese, Blacks, and Whites, respectively. In addition to having the highest prevalence of diabetes, the Hmong also had the worst control of diabetes among the studied groups. The Vietnamese, Laotians, Hispanics, Blacks, and Whites were 5.27, 2.30, 2.02, 1.77, and 1.52 times as likely to have controlled diabetes than the Hmong, respectively. However, it is important to know that there could be other potential confounding factors, including psychosocial factors (diet, lifestyle, socioeconomic), co-morbidities (hypertension, obesity, hyperlipidemia), and medications adherence that were not controlled for in the logistic regression analyses. It would be warranted to repeat the study to account for these confounding factors to draw a more definitive association between race and disease burden of diabetes.

We believe that our study is the first to compare diabetes prevalence between the Hmong, Laotians, Hispanics, and non-Hispanic Blacks. A prior study by Thao et al only compared the prevalence of diabetes between Hmong and non-Hispanic Whites.² In addition, our study provides new insights on the disease burden of diabetes between the Hmong and other high-risk groups. Specifically, among the Hmong, Laotian, Vietnamese, non-Hispanic Blacks, Hispanics and non-Hispanic Whites, Hmong patients had the worst control of diabetes. Our study is also the first of such studies to report this finding.

It is to be expected that the Hmong have a higher prevalence of diabetes and a poorer control of diabetes than non-Hispanic Whites and Blacks. According to the Thrifty Gene Hypothesis, we could speculate that non-Hispanic Whites and Blacks are more acculturated and

less affected by epigenetic influences. However, it is a surprising finding that the Hmong had a significantly higher diabetes burden than the other immigrant groups as one would expect all immigrants to be equally affected by epigenetic modification.^{3,6,11} Potential non-epigenetic factors that may contribute to a high disease burden of diabetes among Hmong include white rice, culture, religion, and their disease model. White rice is still a staple served with every meal, and white rice has a high carbohydrate content.^{8,12} According to Fadiman, the Hmong are strongly influenced by their culture and religion.¹³ Culture and religion influence what they eat, how they live, and how they treat the sick and ill.¹³ Traditionally, the Hmong are animist where they believe that “bad spirits” cause illnesses and death. The sick person would require a spiritual healer called a Shaman to heal them.¹³ Could it be that the Hmong cultural and religious influences, their disease models, and the continued white rice consumption pose barriers to diabetes management that are not faced by other immigrant and ethnic groups? Could these potential barriers contribute to the high prevalence and poor diabetes control in the Hmong community? These are important health questions that need to be explored with future studies, particularly qualitative studies involving interviews of Hmong patients and their providers. Another potential future study would compare the lipid profile, body mass index, and hypertension between the Hmong and the other ethnic, racial groups. These factors increase the risk for developing diabetes mellitus type 2 as when combined with diabetes, they complete the metabolic syndrome.

The findings of this study could change the clinical practice in providing care to Hmong patients. Knowing that the Hmong are at the greatest risk for having diabetes and the worst control of their diabetes when compared to other racial and ethnic groups, it is imperative for healthcare providers to be vigilant about the screening, prevention, and management of diabetes

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among Hmong patients. It would also be important for healthcare providers to address the psycho-social factors, such as diet and lifestyle, that may be contributing to the high prevalence and difficulty of controlling diabetes. Our studies confirmed that this is a growing public health concern for the Hmong community. As such, public health resources should be allocated to promote engagement and partnership between the Hmong community and healthcare workers, through avenues such as educational workshops, dedicated diabetes clinics for Hmong patients, and increasing numbers of Hmong healthcare providers.

Strengths

This study had several strengths, including a large sample of patients and the use of advanced data analytical software in SAS. Furthermore, the team comprised a community-based academic researcher in Asian American health disparities, an experienced biostatistician, and a Hmong medical doctor who is bilingual and bicultural. Query was validated by randomly selecting subjects to verify their diagnosis of diabetes mellitus.

Limitations

The use of a convenient population of study participants in Sacramento that may not be generalizable to the whole country was a limitation. In addition, there were relatively fewer Laotian patients and relatively more White patients as compared to the other ethnic groups. The uneven distribution by race/ethnicity may skew the data, and hence, compromise generalizability.

References Cited

1. Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2017. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services; 2017.
2. Thao KK, Arndt B, Tandias A, et al. The Prevalence of Type 2 Diabetes Mellitus in a Wisconsin Hmong Patient Population. *Wisconsin Medical Journal*. 2015;114(5):190-195.
3. Chakravarthy MV, Booth FW. Eating, exercise, and “thrifty” genotypes: Connecting the dots toward an evolutionary understanding of modern chronic diseases. *Journal of Applied Physiology*. 2003;96(1):3–10. doi:10.1152/jappphysiol.00757.2003.
4. Franzen L, Smith C. Acculturation and environmental change impacts dietary habits among adult Hmong. *Appetite*. 2009;52(1):173–183. doi:10.1016/j.appet.2008.09.012.
5. Ikeda JP, Ceja DR, Glass RS, et al. Food habits of the Hmong living in Central California. *Journal of Nutrition Education*. 1991;23(4):168–175. doi:10.1016/s0022-3182(12)811939.
6. Wilmot EG, Edwardson CL, Achana FA, et al. Erratum to: Sedentary time in adults and the association with diabetes, cardiovascular disease and death: Systematic review and meta-analysis. *Diabetologia*. 2013;56(4):942–943. doi:10.1007/s00125-013-2842-z.
7. Hamilton-Merritt J. *Tragic mountains: The Hmong, the Americans, and the secret wars for Laos, 1942-1992*. Bloomington, IN, United States: Indiana University Press; January 1, 1993.
8. Smalkoski K, Herther NK, Xiong ZB, et al. Health Disparities Research in the Hmong American Community: Implications for Practice and Policy. *Hmong Studies Journal* 13.2(2012):1-31

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9. Pfeifer ME, Sullivan J, Yang K, et al. Hmong Population and Demographic Trends in the 2010 Census and 2010 American Community Survey. *Hmong Studies Journal* 13(2)(2012): 1-31.
10. Bliatout, J. Health And Life Organization, Inc (HALO). Sacramento Community Clinics. Available at www.halocares.org
11. Joffe B, Zimmet P. The thrifty Genotype in type 2 diabetes: An unfinished symphony moving to its finale? *Endocrine*. 1998;9(2):139–142. doi:10.1385/endo:9:2:139.
12. Stewart SL, Dang J, Chen MS. Diabetes prevalence and risk factors in Four Asian American communities. *Journal of Community Health*. June 2016. doi:10.1007/s10900-016-0214-6.
13. Fadiman, Anne. *The Spirit Catches You And You Fall Down: A Hmong Child, Her American Doctors, And The Collision Of Two Cultures*. New York : Noonday Press, 1998.

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Tables

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