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Perceptions to Genetic Technologies from Cardiovascular Disease-Predisposed Asian-Americans

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ABSTRACT

Across available literature, there exists a minimal understanding of understudied ethnic groups and their interactions with genetic technologies. In particular, few studies exist examining Asian-Americans– specifically, those with a predisposition to cardiovascular disease– and their perceptions towards genetic services as a whole. Understanding the experiences of these individuals is key to further tailoring precision health services, and encouraging the collection of diverse genomic data across at-risk populations. A structured, mixed-methods questionnaire was sent to East, Southeast, and South Asian-American respondents with a self-reported history of cardiovascular disease. 55 individual responses were collected, and analyzed in the context of self-reported characteristics and cultural subgroup themes. Across the Asian-American subgroups analyzed, individual location and proximity emerged as a novel theme in accessing genetic technologies. Additionally, numerous participants reported hesitancy towards utilizing these services. Amongst other notable themes, language barriers, cost, and cultural-familial influence persisted as hindrances in one's decision to pursue genetic utility. Despite this, interest among responders for genetic-based treatment or prevention for cardiovascular disease was substantial. Through the identification of potential areas for guided, genetic outreach in Asian-Americans, these results suggest a greater need for incentivizing targeted genetic implementation strategies in minority communities, and include recommendations for future studies in the context of Asian-Americans and cardiovascular health.

Introduction

In the United States, innovation in the field of genetic technology (GT; encompassing genetic testing and counseling, and the use of gene therapy) continues to progress rapidly, with genetic health services being promoted on a broader scale to improve clinical and diagnostic interventions. In the fields of cardiovascular disease (CVD) and cardiovascular medicine, genetic technologies in particular have shown heightened potential in the treatment and prevention of CVD in recent years (Shimamura et al., 2020; Cao et al., 2021). Despite rapid advances within the past 30 years, minority populations continue to be understudied in the field of GT, most especially in terms of Asian-American (AA) utility and usage (Hindorff et al., 2017; Young et al., 2021; Chen et al., 2022). Additionally, large heterogeneity exists among AA subgroups, with the process of data disaggregation and the analysis of diverse populations continuing to be understudied in most research contributing to the GT field today (Druhot & Garip, 2021; Chen et al., 2022). With respect to CVD itself, the prevalence of which differs substantially across AA subgroups, it is crucial that communities are equipped with extended resources to inform decision-making and benefit preventative care (Shah et al., 2022). Understanding personal utility in genetic services, as defined by Kohler et al., particularly in these populations, is vital to amplifying the impact of precision medicine and improving health equity across demographics (Kohler et al., 2017; Hindorff et al., 2017). This research aims to contribute to the aforementioned gap in understanding *specific* Asian-

American usage of genetic services, and how understudied diseases in this context, such as that of CVD, impact access to genetic technologies.

Existing Barriers to Genetic Technologies Among Asian-Americans

Across relevant literature, it is apparent that several key themes in the usage of genetic services across Asian-Americans exist, particularly factors related to cultural variabilities and familial influence. Young and colleagues, in a guiding study analyzing genetic services usage, identified at least six overall themes concerning access, with at least three including a potential language barrier or other communicative barrier, a lack of provider understanding of cultural beliefs, or the use of culturally-rooted community based decision-making in their choice to access genetic services (2021). These factors not only reflect past research on the implications of Asian-American patient counseling– which detail the need for culturally-sensitive outreach and directive interventions– but additionally highlight the need for outreach that extends beyond the 'model minority' stereotype and is not overly broad in its assessment of Asian-Americans (Wang & Marsh, 1992; Chandras et al., 1999; Yi et al., 2016). As a whole, new research in the field of GT must encompass and objectively analyze distinctions among these understudied subgroups.

Other known barriers, in a study of demographic characteristics associated with the personal utility of GT by Miller and colleagues, note the prevalence of individuals who are predominantly White, have received a college education or higher, and have an income above the typical American average (Miller et al., 2023). In communication with the conclusions of Young and colleagues, this data exposes other potential barriers, such as increased awareness of genetic services and local education within communities, the notion of genetic discrimination, socioeconomic status and financial obstacles in testing, and a need for cross-cultural awareness across racial groups with less access to these services or a generally decreased understanding of their benefit (Young et al., 2021). Many Asian-Americans, especially recent immigrants, may also find barriers in the form of healthcare access as a result of acculturation (Read & Smith, 2018; Waldman et al., 2019).

Globally, evidence exists that current genetic technologies do not fully encompass a broad range of potential genetic health conditions, potentially putting Asian-Americans and minorities with diverse and understudied genomes at risk of underdiagnosement. In an analysis of over 9000 East, Southeast, and South Asian genomes, Chan and colleagues identified substantial percentages of genotype-phenotype associations and other genetic variabilities unique of Asian ethnic groups that were not included in the American College of Medical Genetics's recommended screening panel (Chan et al., 2022). To overcome these barriers, it is imperative that a larger understanding of diverse demographics, their genomes, and their experiences or perceptions surrounding genetic health services be analyzed in a beneficial context. While many recently published papers, such as in a study by Scherer and colleagues, strive towards this goal through genetic services perception analysis of specific subgroups such as Filipino-Americans, it still is important to view them through the lens of a specific disease: cardiovascular disease (Scherer et al., 2024).

Cardiovascular Disease and Guiding Points in the Context of Asian-Americans

Within the past decade, established authorities in the field of cardiovascular health have noted certain variabilities in CVD prevalence and risk across a diverse array of Asian-American demographics. In health data collected between 2007-2018, the American Heart Association (AHA) finds that the prevalence of CVD continues to increase across all analyzed subgroups in comparison to non-Hispanic Whites – excluding certain Japanese and Pacific Island populations, who have stagnated – and with Filipino populations continuing to increase at higher rates (Nguyen et al., 2022). This research reflects the variability of CVD trends in minoritized populations, as health data also collected by the AHA from 2003-2017 reflects that standardized mortality rates of CVD across Asian subgroups, in terms of ischemic heart disease and heart failure, stagnated across certain Chinese, Korean, and Japanese groups (Shah et al., 2022). In a broader context, CVD-related health risks also exist within the AA community as a whole, with research suggesting that a substantial population of Asian-Americans possess a less-than-ideal standard of physical activity (Lopez-

Neyman et al., 2022). Despite this, recent studies show that Asian-Americans– particularly those affected by hypertension– are continuously looking for more information on ways to treat or manage these conditions, indicating a further need to understand the effects of innovation in fields such as genomic medicine and the like (Jung et al., 2019).

Genetic therapies in the fields of cardiovascular medicine have been understudied, especially in their usage by minority demographics. More specifically, their perceptions and usage by Asian-Americans (also in the studies of genetic testing) continue to be relatively unexplored in comparison to other diseases such as Parkinson's and cancerous diseases (Tan et al., 2007). To date, research on the clinical applications of gene therapy in cardiovascular medicine continue to be explored, with methods such as gene silencing continuing to be used in clinical trials and used as preventative treatments for patients with notable conditions such as hypertension, dyslipidemia, and more (Shimamura et al., 2020; Mendes, 2020; Cao et al., 2021).

As usage of these therapies grows in clinical applications, it is crucial to know how potentially underserved communities perceive their use and how they may best benefit from these resources.

Summary of Objectives

Overall, there is a prevailing lack of studies in the field of genetic medicine that directly question Asian-Americans about their perceptions of genetic technologies, more so, that address these topics in the context of cardiovascular health. Certain factors, such as the availability of genetic services in an area and individual access to healthcare, also remain understudied in analyzing personal usage. This leads to the question: *What underlying barriers or perceptions may prevent CVD-predisposed Asian-Americans from accessing gene technologies?* This research aims to accomplish specific objectives: contributing to the analysis of AA genetic services usage through direct questioning, rather than indirect methods in secondary data analysis such as systemic reviews, understanding if identified barriers to GT are comparable to those of CVD-predisposed individuals, contributing to needed data disaggregation in genetic medicine by analyzing AA subgroups in-depth, and identifying potential areas in guiding targeted CVD-prevention outreach in these communities (Figure 1).

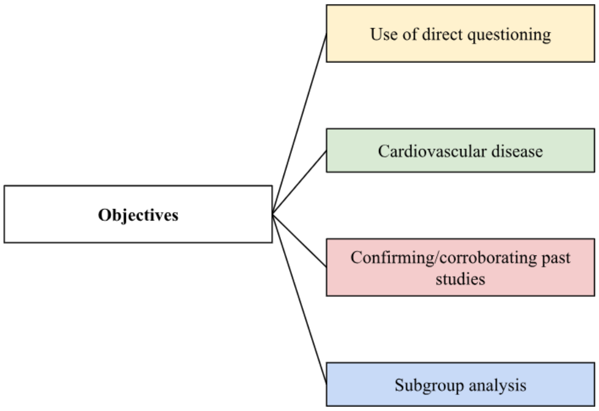


Figure 1: Prevailing Objectives in Addressing the Perceived Gap

Data Collection Structure

Summary of Data Collection Approach & Design of Methodology

As described previously, a comprehensive process of data collection will be utilized that best addresses the primary research goals. In particular, data collection will aim to build a more specific understanding of genetic technology attitudes towards CVD in Asian-Americans through a *structured, mixed-methods questionnaire* (**Appendix A)** with a multi-faceted approach through themed sections (*Figure 2*). A mixed-methods approach will allow for numerous aspects of respondent perception and background to be studied in detail, as explained in the sections that follow. The themed sections shown in *Figure 2* highlight the intended analyses of the study.

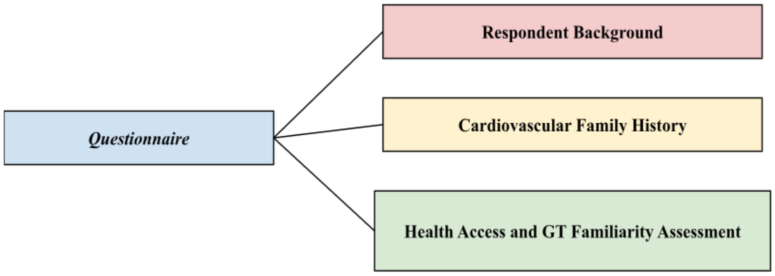


Figure 2: Themed sections of the Questionnaire

Previous studies concerning attitudes, knowledge, and general interest towards genetic testing/genetic technologies in Asian and diverse populations have made use of standardized questionnaires and surveys, such as that conducted by Tan and colleagues, assessing attitudes of GT for Parkinson's disease, and Armstrong and colleagues, assessing interest in genetic testing for BRCA1 (Armstrong et al., 2002; Tan et al., 2007). Similar to this research, the structured questionnaire used in this study will include an assessment of one's current knowledge or familiarity of genetic technologies in the context of cardiovascular disease, verifying individual predisposition to CVD in the family history section through self-reporting. Additionally, as concluded by Young and colleagues, and in line with other previous inquiries concerning barriers to genetic testing/healthcare, the design of the survey will assess certain independent variables to the respondent background that may influence health access or perceptions of care as follows: age, gender, income, availability of health insurance, education level, and culture or language (Reed & Smith, 2018; Young et al., 2021). An important aspect of this design is the ability to study and analyze respondent data based on the self-identified individual Asian subgroup, a recommendation introduced in the guiding study by Young and colleagues that has typically been understudied in recent genetic utilization research concerning Asian-Americans (Young et al., 2021). For the purposes of this study, the largest Asian subgroups in the United States (as identified by the Pew Research Center) will be studied, in addition to other Asian ethnic subgroups belonging to these major Asian regions (*Figure 3*).

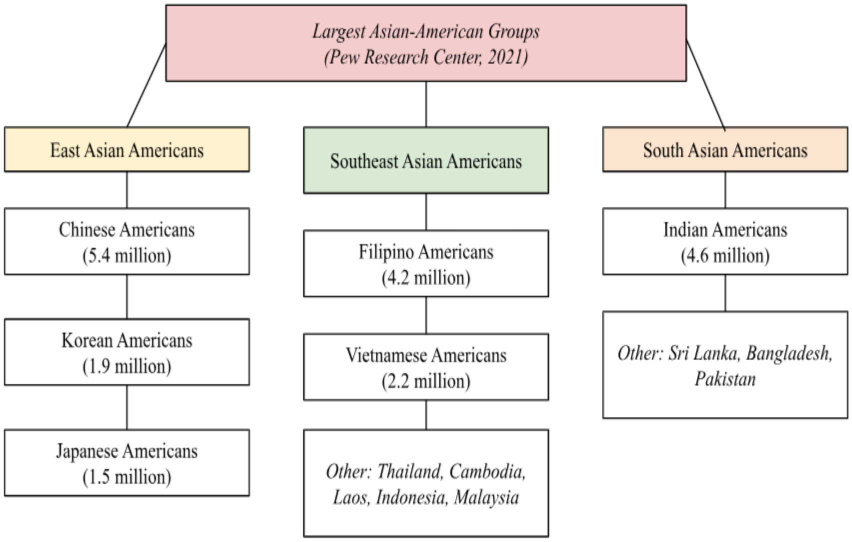


Figure 3: Subgroups of Asian-Americans Identified in this Study (Pew Research Center, 2021).

Sampling of Respondents and Delimitations

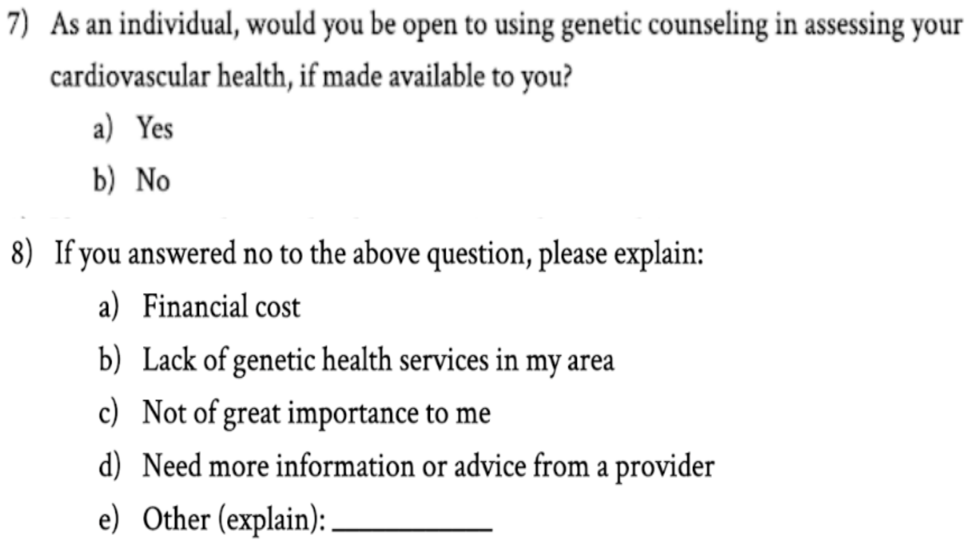
The data used in this study will be collected from all major regions of the United States, in particular, the New England and Western regions. Ideally, all respondents will be citizens and identify culturally/claim ethnic heritage with one of the aforementioned Asian subregions listed above. Additionally, respondents should, as established in the cardiovascular history section of the questionnaire, indicate a personal or familial history of cardiovascular disease. This study is narrowed strictly to respondents that fit the criteria mentioned and are between the ages 18-55.

As indicated by the parameters above, this study will utilize a non-randomized sampling method, specifically, purposive sampling, in an effort to accurately encompass a wide range of experiences and perceptions across a broad range of Asian ethnic subgroups (i.e all respondent data matching the background criteria will be included in the analysis). Purposive sampling ensures that the data collected is strictly in line with the original goals of the study, that is, the intent to explore perceptions of GT among Asian-Americans in the direct context of cardiovascular health. Purposive sampling has also been used in areas of genetic technology utilization research to assess respondent qualities and opinions in the areas of Parkinson's disease, breast cancer, and other forms of inherited or genetic disease (Tan et al., 2007).

Summary of Thematic and Data Analysis Procedure

In comparison to other studies concerning genetic health services utilization, this study will not collect any personally-identifying health information, disregarding the need for data collection in accordance with the Health Insurance Portability and Accountability Act (HIPAA). All respondents will be directed to review a consent form (Appendix B) to which their completion of the questionnaire indicates an agreement to the conditions listed in the form itself. After survey time has elapsed (1~2 months), all respondent data will be analyzed.

In line with traditional mixed methods survey research, quantitative questions (*Figure 4)* will be analyzed based on the overall prevalence of a response to a question (n = X, % of group) and in the context of certain aspects of the respondent's background, such as cultural subgroup or personal characteristics identified in the self-identify section of the questionnaire. Such data may indicate a rough correlation between one or more independent variables described, especially when compared to respondent data of a similar background. This type of manual, observation-based analysis will replace the typical statistical analysis often used in these studies (multivariate analysis) as has been used in the past Parkinson's disease study, which may be used for certain questions to understand a potential correlation as stated previously (Tan et al., 2007). Responses to qualitative, open-ended questions (*Figure 4)* will be analyzed based closely on certain themes identified in the guiding study by Young and colleagues, namely that of *culture, communication barriers, concerns towards genetic testing,* and *general awareness of genetic technologies* (Young et al., 2021). Open-ended responses will be analyzed verbatim and quoted to ensure that unique characteristics are accounted for in data analysis. As a whole, all collected data will be reviewed independently by the researcher, and sorted according to the characteristics identified.



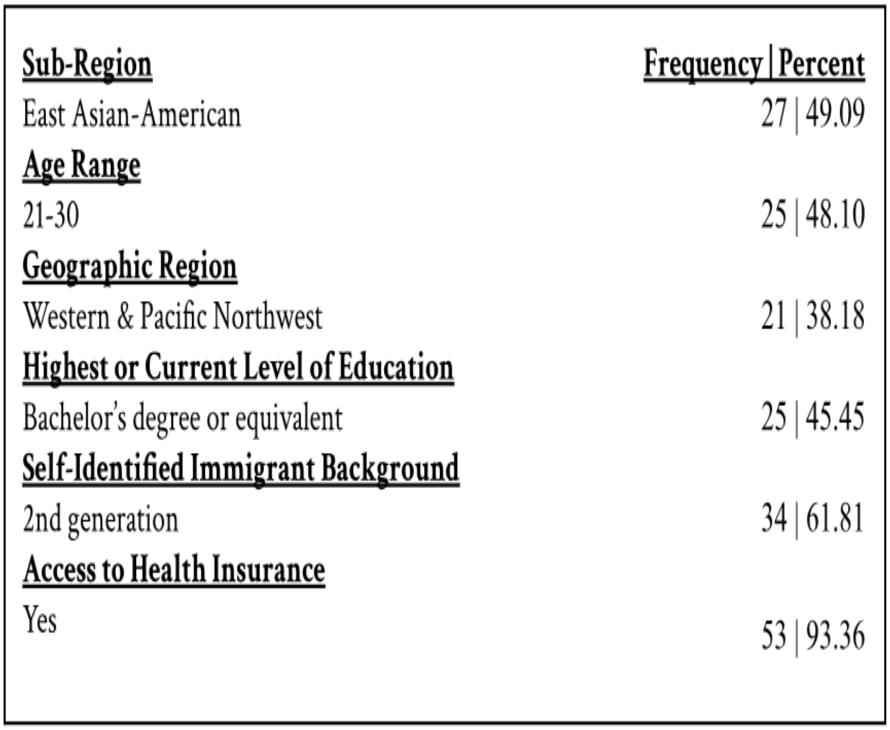
7) As an individual, would you be open to using genetic counseling in assessing your cardiovascular health, if made available to you?
   a) Yes
   b) No

8) If you answered no to the above question, please explain:
   a) Financial cost
   b) Lack of genetic health services in my area
   c) Not of great importance to me
   d) Need more information or advice from a provider
   e) Other (explain): ___________

Figure 4: Examples of Qualitative and Quantitative Respondent Questions

Findings

A total of 80 responses (n = 80) from two sources– Dear Asian Youth, a US-based organization of predominantly Asian-American young adults, and Prolific, a paid research site, were received for initial analysis. In line with standards of data replicability and data collection improvement, verification via the use of effective, built-in attention checks (Abbey & Meloy, 2017) and the use of visual observation for qualitative answers resulted in the discarding of 25 responses (n = 25) that contained data that either could not be analyzable (answers were clearly not relevant to the question asked, or the use of an outside source (i.e. generative software) was evident), or the respondent background did not meet the outlined survey criteria (Appendix A). After discarding, a total of 55 analyzable responses (n = 55) were collected (Figure 5).



Sub-Region	**Frequency | Percent**
East Asian-American	27 | 49.09
Age Range	
21-30	25 | 48.10
Geographic Region	
Western & Pacific Northwest	21 | 38.18
Highest or Current Level of Education	
Bachelor's degree or equivalent	25 | 45.45
Self-Identified Immigrant Background	
2nd generation	34 | 61.81
Access to Health Insurance	
Yes	53 | 93.36

Figure 5: Summary of Demographic Backgrounds (Asian Sub-Region, Age, US Geographic Location, Gender, Education, Income Ranges, Immigrant Background, Occupation, Access to Health Insurance) of Surveyed, CVD-predisposed Asian-American Respondents

Based on the demographic results of the respondents, it can be directly observed that many of the findings center around the experiences of individuals who are young (aged <30), middle-class, typically 2nd-generation East Asian-American, with a Bachelor's degree or higher, and with access to reliable health insurance. Individuals with these educational backgrounds comprised a majority of the respondents completing this survey, at about 73% (n = 40) of the total 55 respondents analyzed.

Geographic distribution remained relatively constant among respondents. However, a substantial portion of respondents were located in the Western/Pacific regions of the United States, with about 38% (n = 21) respondents located in states in these regions. Respondents' self-identified employment status indicated that numerous respondents were students (n = 17), employed in healthcare (n = 10), or identified as self-employed (n = 12).

More than half of all total respondents indicated a 2nd-generation immigrant status, with about 61% of respondents identifying as having been born in the United States and having at least one foreign-born parent (n = 34). This is followed by respondents who identified themselves as having a 1st-generation immigrant status, or who are otherwise immigrants to the United States (n = 19).

With regard to self-identified household income range, over 1/3 of respondents tended to fall within the $60,000-$100,000 range (n = 21). The vast majority of respondents identified as having an annual household income below $100,000 (n = 36).

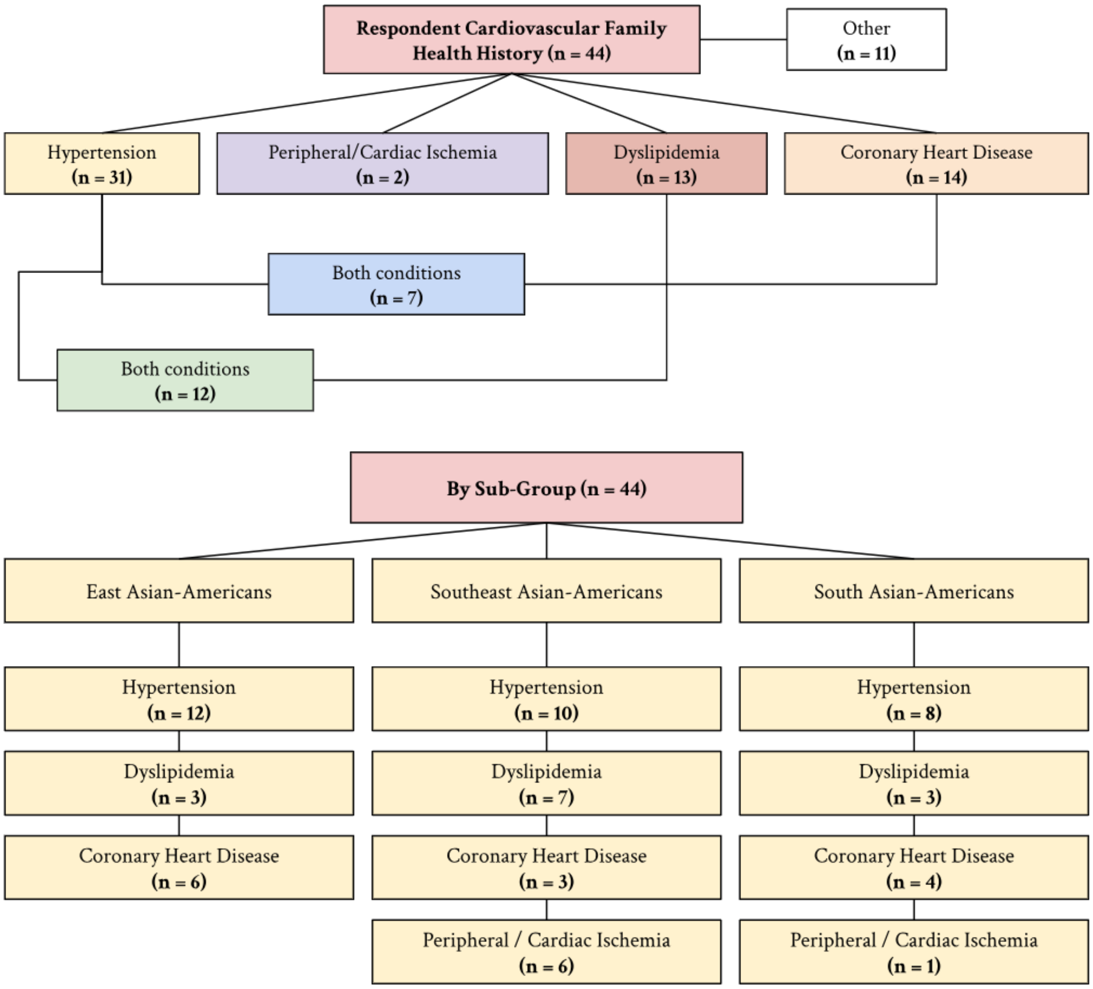


*Figure 6: Self-Reported Cardiovascular Disease History of Surveyed Asian-American Respondents**

**Respondents had the option to indicate multiple conditions.*

A total of 44 (n = 44) respondents indicated a family history of hypertension, peripheral/cardiac ischemia, dyslipidemia, or coronary heart disease, with the remaining 11 respondents indicating some other form of family cardiovascular history (n = 11). Respondents were given the choice to select multiple conditions as it pertained to their family history (*Figure 6*). By far, instances of hypertension/high blood pressure were most common, with nearly 31 self-reported instances (n = 31) among the 44 analyzed respondents. This was followed by 14 instances of coronary heart disease (n = 14), closely followed by 13 instances of dyslipidemia (n =13) among respondents. 12 respondents (n = 12) indicated the presence of both hypertension and dyslipidemia in their immediate family, whereas 7 respondents (n = 7) indicated the presence of both hypertension and coronary heart disease in their family health history.

With respect to specific Asian-American subgroups, cardiovascular health history results appeared to be closely distributed in instances among self-identified conditions. Southeast Asian-American respondents indicated a higher prevalence of dyslipidemia (n = 7) and peripheral/cardiac ischemia (n = 6) than East Asian-American and South Asian-Americans, respectively. All three subgroups clearly indicated a substantial prevalence of hypertension, with 12 instances in East Asian-Americans (n = 12), 10 instances in Southeast Asian-Americans (n = 10), and 8 instances in South Asian-American respondents (n = 8).

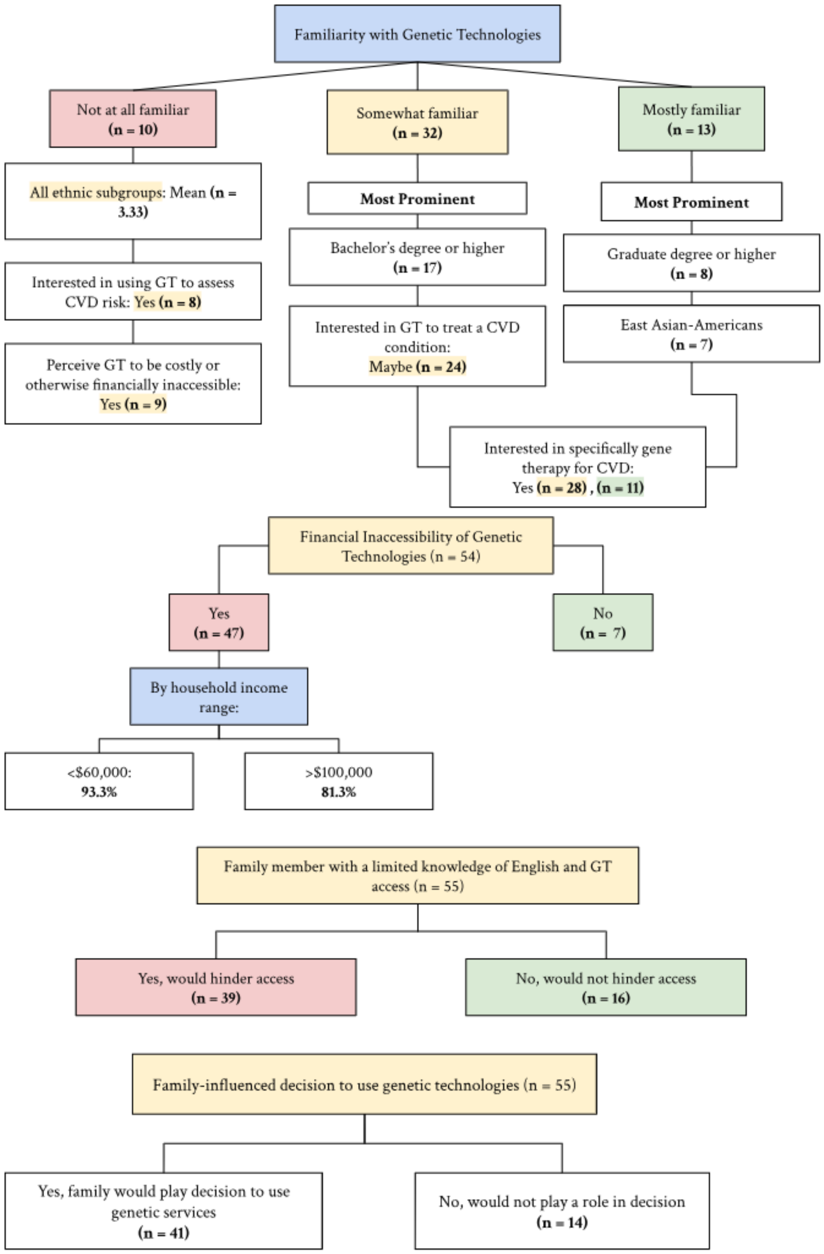


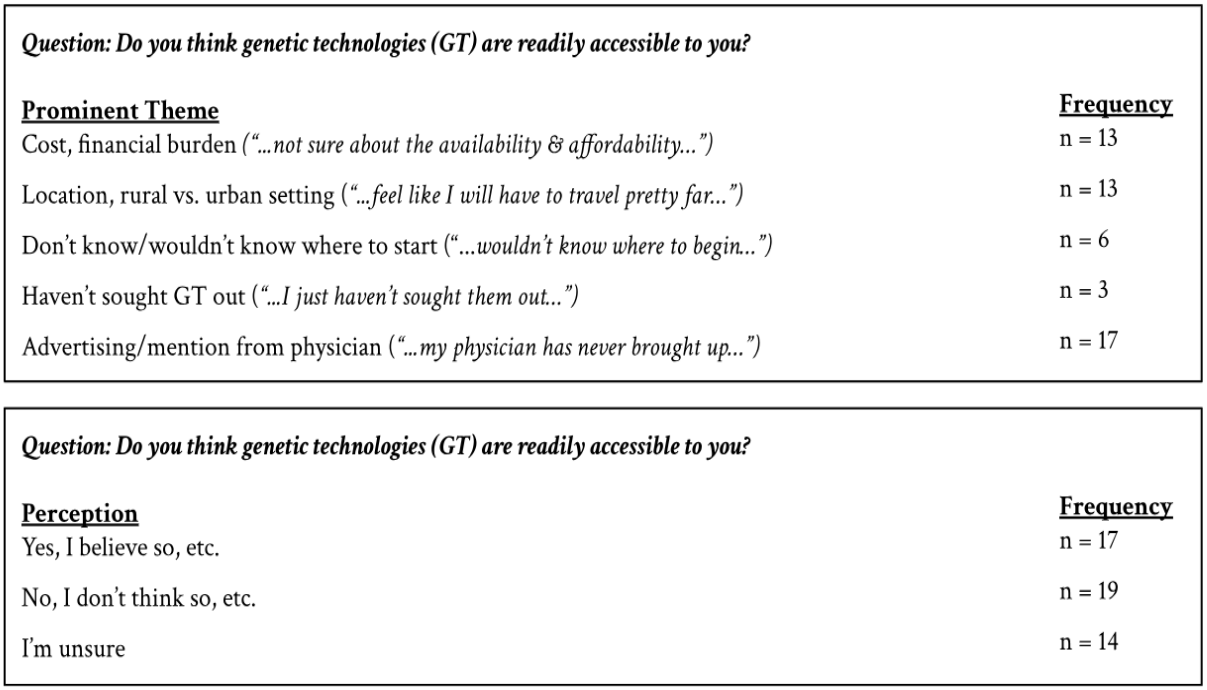
Figure 7: Branched Results of CVD Asian-American Perceptions to Genetic Technologies, General and by Demographic Sub-grouping

More than half of the 55 respondents (n = 32) self-identified as being ‘somewhat familiar’ with genetic technologies (*Figure 7*). Prominently, a substantial proportion of these respondents had at least a Bachelor’s degree-level education (n = 17), and 24 of these respondents (n = 24) also indicated that they were interested in precision medicine to treat a cardiovascular-related health condition. Specifically, in the context of genetic therapy, 28 respondents (n = 28) indicated an interest in the field as a treatment.

13 respondents self-identified as being ‘mostly familiar’ with genetic technologies. A large, substantial portion of these respondents possessed a graduate-level education or higher (n = 8) and were East Asian-American (n = 7). Out of these 13 respondents, 11 indicated that they also were specifically interested in gene therapy as a potential treatment to a cardiovascular-related health condition.

All ethnic subgroups analyzed possessed a mean respondent value of n = 3.33 when self-identifying as ‘not familiar at all’ with respect to familiarity with genetic technologies. In total, 10 respondents (n = 10) indicated that they were ‘not familiar at all’ with the technology, and 9 of these respondents indicated that they perceived genetic technologies to be costly or otherwise financially inaccessible in a later question (n = 9) . Despite this, 8 of the 10 respondents indicated a willingness to use genetic testing/counseling to assess cardiovascular risk (n = 8).

Financial factors proved to be a common theme among respondent answers, with nearly 87% of total respondents (n = 47) perceiving genetic technologies to be costly or otherwise financially inaccessible. Furthermore, 71% of respondents (n = 39) indicated that they felt a lack of English proficiency (such as for a family member) would pose a barrier to genetic technology access. Additionally, with respect to genetic ‘discrimination’, over half of respondents (n = 30) felt that it posed a barrier to their personal or family member’s use of genetic health services. With relation to a family-based decision to use genetic technologies, a vast majority of respondents (n = 41) indicated that family or close relatives would play a role in this process. While the aforementioned statistic may be applied to other forms of healthcare alongside other ethnic groups, it is worth noting that it varied substantially across the surveyed subgroups in this study, with South Asian-American respondents displaying higher indications.



Question: Do you think genetic technologies (GT) are readily accessible to you?

Prominent Theme	**Frequency**
Cost, financial burden (*“...not sure about the availability & affordability...”*)	n = 13
Location, rural vs. urban setting (*“...feel like I will have to travel pretty far...”*)	n = 13
Don’t know/wouldn’t know where to start (*“...wouldn’t know where to begin...”*)	n = 6
Haven’t sought GT out (*“...I just haven’t sought them out...”*)	n = 3
Advertising/mention from physician (*“...my physician has never brought up...”*)	n = 17

Question: Do you think genetic technologies (GT) are readily accessible to you?

Perception	**Frequency**
Yes, I believe so, etc.	n = 17
No, I don’t think so, etc.	n = 19
I’m unsure	n = 14

Figure 8: Quantitative Results to Self-Reflection of Genetic Technologies, General Results and Sub-grouping
**Responses may have indicated more than one theme.*

After analysis of n = 55 qualitative answers to the self-reflection of genetic technology accessibility, 5 major themes emerged after keyword coding, modeled after the findings from the guiding paper by Young and colleagues (*Figure 8*). These themes included responses that made references to cost/financial burden, location factors, hesitancy to start, lack of need for GT, or a reference to overall advertising or mention by a primary care provider. By far, mentions from a physician/provider or ‘advertising’ comprised many of the responses, with 17 mentions across answers (n = 17). Cost and financial burden shared equally similar concern/weight among respondents, as both shared

13 mentions (n = 13), respectively. Personal perceptions appeared to be split, with a substantial amount of respondents indicating a degree of unsureness (n = 14).

These themes were recurrent among individuals who had already undergone genetic testing, or indicated a previous experience with genetic technologies. For example, a South Asian-American woman from New York who had undergone genetic testing through her OB-GYN felt that tests were accessible if an individual specifically asked for them, and commented on the high costs of the genetic technologies she used. A student in California, aged 21-24, who indicated that she had been referred for genetic services in the past, also commented on the fact that she perceived genetic technologies to be "not advertised as much".

While not explicitly coded, numerous respondents indicated a certain level of self-awareness with respect to their personal backgrounds. For example, a 31-40 year old male making between $80,000 and $100,000 as a clinical researcher in New York indicated that he, in part due to his financial and employment background, felt better equipped to utilize genetic resources. Similarly, 2 responses from individuals with family or personal backgrounds as a physician/healthcare provider (n = 2) both shared similarities, in that respondents acknowledged proximity to these resources ("*My family member is a healthcare provider and we are financially stable, so I think we would not have a hard time finding resources related to genetic testing.")* An 18 year old student from California shared similar sentiment with regard to location, indicating his belief that his proximity to academic institutions in an urban setting provided him with greater opportunities to use these services. As such, these remarks from respondents may be indicative of a larger awareness towards genetic services than previously thought, which must continue to be explored in detail.

Discussion and Analysis

The data collected from this three-part survey is consistent with the overall demographic conclusions noted in the previously-referenced study by Miller and colleagues, but is novel in that the results of this study present education and higher-level income as a surface-level indicator of perceived accessibility to genetic technologies across CVD-predisposed Asian-American respondents, as the initial assumptions in the literature review indicated (Miller et al., 2023). The presence of a Bachelor's degree or higher-level education, as noted in this study's findings, comprised the vast majority of all respondents across all analyzed Asian-American subgroups, further suggesting the importance of understanding background demographics in individual perceptions towards genetic technologies. In terms of income, *negative* perceptions towards cost and genetic technologies did not shift substantially between individuals whose household income was well below the American mean, and those whose households made well beyond $100,000 annually– further suggesting that the consistent perception of cost among potential users of these technologies is one that must continue to be explored with respect to GT accessibility.

An emerging theme from this study not prominently discussed in other forms of relevant literature was location. Relatively novel and unexplored in comparison to the findings of other related analyses, numerous responses indicated a lack of proximity to health centers or their residence in a more rural location as a potential barrier to their use of genetic technologies. On the other hand, several responses indicated the opposite– instead, one's closer proximity to more urbanized centers or academic institutions– which introduces the notion that physical residence may substantially influence one's perception of GT, in particular. When more broadly analyzed in the context of Asian-Americans who may live in typically rural areas, such as those predominantly employed in agriculture or other related occupations, it suggests that GT outreach must continue to make a conscious effort to expand in these areas to make this information much more accessible to the general public, and to diverse communities (Census of Agriculture, 2017).

While location was a conscious barrier to some respondents in accessing GT, the internal barrier of hesitancy or unsureness towards using these technologies in the first place was also a persistent, relatively unexplored theme among respondents. In other words, respondents who reflected on past visits with a provider indicated that the 'advertising' of genetic technologies (most likely broadly used to refer to general discussion directly to themselves or provider referral) had been limited to nonexistent, suggesting that the value of GT is something that may not be explicitly or consistently emphasized to potential patients of benefit in Asian-American communities. As such, a general perception of 'not knowing where to start' (with relation to genetic-related health services) was communicated by numerous respondents– including in those who had previously utilized or been referred for genetic health services– potentially highlighting a need for genetic-based health outreach or the broader health community in general to emphasize.

The prominence of cultural factors in Asian-American communities in terms of healthcare usage has been critically studied, with the questions of this study alluding to elements such as group-decision making and collectivism that have been analyzed in previous studies concerning AA healthcare (Lowe, 2005). With South Asian-American respondents indicating the highest percentage of a family-influenced decision to use GT, despite being one of the smallest analyzed Asian-American subgroups in this study, it is evident that certain cultural differences exist across ethnic groups that must be studied in the context of Asian-American healthcare, and ultimately, genetic outreach at large. Furthermore, in reference to the percentage of respondents across all analyzed groups who indicated a potential linguistic barrier to their use of GT, health services must continue to be supportive of patients who do not speak English as their primary language and be cognizant of these barriers when directing potential referrals or directions for care.

Opportunities and interest for CVD treatment via the use of genetic technologies was consistent and substantial across all Asian subgroups. The quantitative prevalence of CVD conditions– in this study, predominantly hypertension and dyslipidemia– across all surveyed groups, provides a potential incentive to research pertaining to possible genomic research for these groups and individuals affected by these conditions at-large. It is evident that Asian-American populations– in this study, seen in respondents' self-reflections– are cognizant of their family history of CVD, and remain interested in solutions that best interest them and their families.

Conclusions

Novel Findings and Addressal of Gap

Overall, the data presented in this study suggests, very *broadly*, that across major Asian-American subgroups, individuals predisposed to cardiovascular disease may display similar internal and physical barriers to accessing genetic technologies. Notable themes not addressed in previous studies concerning genetic technologies and Asian-Americans emerged, including negative perceptions of cost, physical proximity to health services, and perceptions surrounding 'advertisement' from a primary care provider. Culturally, respondents across the three surveyed Asian-American subgroups reported potential linguistic barriers, and hinted at the larger role of family influence on genetic health utilization, lending support to findings described in the guiding study by Young and colleagues (Young et al., 2021).

In the context of the research question, this paper is novel in that it helps to provide possible guiding suggestions for future genetic health services outreach, as well as for new innovations concerning cardiovascular disease screening in predominantly Asian-American communities. It provides both quantitative and qualitative data from direct questioning that hint broadly at persistent conditions among Asian-American subgroups, as well demonstrating potential interest among respondents for genetic-based cardiovascular screening that addresses them. As a whole, this paper contributes to the current body of knowledge through its identification of potential areas for guided, genetic cardiovascular outreach in Asian-Americans, as well as its initial steps into data disaggregation among certain Asian subgroups.

Inquiry Limitations

This study includes numerous technical limitations, which includes the fact that some respondents did not completely answer all of the questions presented. While not substantial, this presents an issue with the overall number of recorded instances displayed in the 'findings' section, and was adjusted accordingly in certain areas (percentages were adjusted to account for the number of respondents total who responded to a question). Additionally, the data collected in this study was analyzed by a single researcher, and as mentioned previously, based largely on observable, visual differences between subgroups and demographic backgrounds. This fact may also affect the objectivity of the data collected.

By far, the largest limitation to this study is the limited sample sizes present across surveyed Asian-American subgroups, which made correlational relationships not possible to conclude in this study. Many responses collected initially were cut from analysis due to a failure to meet respondent criteria or survey requirements. As such, the themes presented in this study are merely suggestions for future research, and cannot be extrapolated to the broader Asian-American community as a whole. Additionally, the data in this study is inherently biased in that it is limited to Asian-American respondents with Internet access, and a strong command of or fluency in the English language.

It is important to note that the responses presented merely reflect perception, and not the potential, future actions of respondents. In the case of genetic discrimination, for example, it is difficult to ascertain if the individuals indicating 'yes' would raise questions about this information from a provider in a clinical setting. Again, the responses collected in this study should only be used as guiding suggestions in health-centered outreach towards Asian-American communities.

Future Recommendations

An ideal, improved version of this study would aim to use intensified, in-person recruitment efforts to survey a much larger population of Asian-Americans, which would 1) help to understand the perceptions of certain unrecognized groups in this study (ex. Asian-Americans of whom English is not their primary or first language) and 2) open up possible opportunities for individualized studies that focus only on certain Asian-American subgroups (ex. South Asian-Americans, Chinese-Americans, etc.) An improved study would ideally collect enough data among its participants to potentially analyze correlational data, which would help contribute further to needed research in these areas, as well as data disaggregation among Asian-American subgroups. Additionally, future studies utilizing a genetic assessment tool should aim to incorporate elements such as the two-factor model, identified by Fitzgerald-Butt and colleagues for measuring genetic knowledge in adults and adolescents (2015). This method of analysis was not used in this study due to single-researcher constraints.

Future research should continue to examine the role of health access in rural communities, especially as it pertains to the use of genetic technologies. Additionally, providers should aim to analyze further new implementation strategies for health translation services in communities where English is not the first language, especially in genetic health clinics or those that take part in the field of precision medicine. The suggestions presented in this study should aim to incentivize genetic health outreach efforts as a whole to Asian-American communities among researchers, noting themes such as culturally-aware advertising and ways to reduce the barrier of physical proximity to health services. Though this study does not fully encompass the full experiences and perceptions of Asian-Americans predisposed to cardiovascular disease, it suggests that there is still a dire need to understand how exactly present and future innovations– such as through genetic medicine– can help to alleviate the burden this disease places on minority populations.

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