

## **Inequality in Medical-Genetic Research Towards Minority Groups and Approach to the Case of People of African Descent in Mexico**

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**Abstract:** As part of the third objective of sustainable development, the international community has committed to promoting the health and wellbeing of all the inhabitants of the planet and this includes not only combatting diseases but also the promotion of public health and research. Unfortunately, the achievement of this goal has been significantly hampered by social factors such as poverty, inequality and the lack of access to basic levels of well-being of the entire populations of certain countries. In some of these countries such as the case in Mexico not all the population are able to reap the benefits of the advances and investments made by the state. An investigation was carried out into the complete mitochondrial DNA genome sequence of the Mexican population with the results forming part of the nucleotide of the National Center of Biotechnology Information (NCBI). However, this database appeared to lack information relating to certain haplogroups, for example, Afrodescendant mexicans and thus was not a representative population sample for a country with entire regions where this phenotype was in the majority. This factor limited both the research and the inclusion of these groups in public health policy.

**Key words:** Inequality, genome, research, discrimination, haplogroups, DNA

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### **INTRODUCTION**

In January 2017 Oxfam shocked the world by issuing data showing that “just 8 people (actually 8 men) have the same amount of wealth as 3,600 million people, the poorest half of humanity”. This statistic gives us both reliable and extremely significant information which without doubt, shows inequality as one of the great challenges facing the world today. What is the situation of extreme inequality in countries such as Mexico? In order to answer this question we refer to the definition offered by Esquivel (2015). According to the Standardized World Income Inequality Database, Mexico has a Gini coefficient of 0.441 (Solt, 2016), meaning that the country occupies 87th place out of 113 participating countries and that 76% of these countries enjoyed lower income inequality. The world development Indicators, a study carried out by the World Bank, uses a different methodology and gives Mexico a Gini coefficient of 0.483. This measurement awards Mexico place number 107 out of 132 participating countries, indicating that 80% of these countries enjoy lower inequality. It can therefore reliably be said that “Mexico is one of the 25% most unequal countries in the world” (Esquivel, 2015).

Although, this information is extremely significant and to a certain degree, alarming, inequality is not only related to the lack of economic resources but also is clearly linked to the lack of opportunity to take advantage of the resources available, whether these be educational, social or political (Lagner, 2017). In its approach to Sustainable Development Goals (SDG), the United Nations Development Program (UNDP) emphasized that, in order to fight inequality effectively, approaches should take into account aspects such as economic, social, scientific, educational, political technological and scientific inclusion (Anonymouse, 2015).

Despite the emphasis of the UN program and specifically in relation the latter point, the great scientific advances experienced by society in the last decade have not necessarily benefitted everyone (Di Nasso, 2004). In terms of health, it cannot at this point in time be guaranteed that recent advances in medicine will be available to all and this is due to the fact that health research is in large part undertaken by the pharmaceutical industry thus presenting a disconnect between the simultaneous need for profitability and public health (Borrell, 2015). In contrast, universities, also key players in the field of research, have sought to make the results of

their investigations widely available through open-access policies. However, what happens when the research depends on information which marginalizes certain population groups? What should be done when inequality affects data research processes right from the start?

This study seeks to shed light on the link between the link that should exist between inequality-reduction and other objective of sustainable development, above all those which directly affect the lives of the poorest members of society. The text will focus specifically on analyzing the health requirements which comprise the third objective, considering that one of the greatest challenges faced by nations is creating improved health outcomes for the population, not only as a necessity but also as a human right. Unfortunately, any discussion of universal health is at risk of becoming overshadowed by other areas such as poverty, hunger, lack of development, access to water, poor environmental conditions and of course, inequality.

Using research into the complete mitochondrial DNA genome sequence of the Mexican population taken from the National Center of Biotechnology Nucleotide Information (NCBI) database, it was determined that very little information existed in relation to certain haplogroups such as Afrodescendant Mexicans, and that this did not correspond to national population samples where entire regions showed a significant proportion of people with this phenotype. This could clearly be a limitation for the research and for the inclusion of these groups in public health policy and ultimately a clear breach of their right to health as well as their ability to take advantage of the possible benefits of the study.

With the past clearly marked by the differences and inequalities between different population groups, this study seeks to create an approximation of the reality in Mexico and considers that the historical background of social injustice can be linked to present research and the plans of the nation in the area of public health. Firstly, there will be an exploration of the historical origins of racial segregation in order to subsequently offer a more in-depth analysis of the results.

## MATERIALS AND METHODS

**Socio-historical background of afrodescendant Mexicans:** The idea of racial mixing in Mexico has for a long time been seen as the unique product of the intermingling of indigenous groups with those of European descent who arrived in distinct waves after the conquest in the 16th century (Marti, 2016). However, there

is a “third race” which has been almost completely ignored despite its significant contribution to art, culture and other related areas and has been a constant influence in the history of the country. This “third race” is the African and Afrodescendant Mexican variable (Velazquez and Iturralde, 2012).

The pervasive influence of African culture and the visibility of people of African descent however has been ignored throughout history, dating from the first days of the Spanish conquest (Garcia, 1989). Africans were present right from the first incursions into the American continent and despite being rendered invisible they were in fact part of not only the conquest but related business enterprises. It was believed that by rendering Africans invisible and concentrating overwhelmingly on the presence of indigenous and Spanish population groups, post-conquest assimilation and colonization would be both facilitated and simplified.

During the Viceroyal period (16th-18th centuries), thousands of African men and women were imported into the territory then known as New Spain to be bought and sold as slaves and put to work in the most difficult areas. These included mining, silversmithings and animal husbandry enterprises, the latter involving the herding of livestock over vast areas of conquered territory (Klein, 1999). It is estimated that at the end of the 16th century there were approximately 20,000 Africans in New Spain, based principally in the regions known today as the states of Veracruz, Guerrero, Puebla and Oaxaca (Flores *et al.*, 2017). Their presence was constant during this time period and is apparent in eye-witness accounts, documents, wills and paintings where they are frequently portrayed as workers in both urban and rural colonial settings (Eltis, 1987).

The Africans who were enslaved were originally from the Atlantic coasts of countries known today as Guinea, Congo, Angola and Mozambique, from whence they were transported in ships that could carry up to 450 people at a time. The mortality rate of the human cargo however was high, at about 30% per voyage (Miller, 1988). Those who survived the voyage (which could take between 2-3 months) arrived at gateways to America such as Cartagena, San Juan or Havana where they were then sold in slave markets and distributed throughout the Spanish Empire. In New Spain recently-arrived slaves came ashore in Veracruz and were rapidly dispersed to different regions where they were put to work for large landowners and important businesspeople in the colony (Peralta, 2005).

Although, a few slaves managed to escape their condition (either by fleeing, being liberated by their

owners or buying their freedom), the majority lived in precarious conditions and were considered to be at the bottom of the social pyramid of new Spain. These conditions prevailed even though the country was eventually granted independence from Spain at the beginning of the 19th century and continue to this day in the poorest parts of the country (Garcia, 1989). In addition to the institutionalized discrimination that Africans and their descendants suffered during the Viceregency, the different forms of legal vulnerability which appeared during the post-independence period have caused the marginalization of today's Afrodescendant Mexican population. Afrodescendant Mexicans are unrecognized officially as a distinct ethnic group as they do not conform to the prevailing Spanish-indigenous paradigm and because of this they are left out of official Mexican cultural heritage and awareness policies (Arroyo-Ortega and Alvarado, 2017).

After the Mexican Revolution and with the creation of the National Institute of Anthropology and History (INAH) in the 1930's, studies began to take place into the cultural diversity of Mexico. These studies permitted a more in-depth understanding of the elements of cultural richness brought to the country by other races. In the middle of the 20th century, a pioneering study was carried out by the anthropologist (Aguirre, 1946) which opened the doors to more accurate studies of the Afrodescendant Mexican population with approximately 250,000 black slaves having been brought to New Spain between the 16 and 17th centuries. By chance, this coincided with a significant fall in the indigenous population, although this was later to recover. Africans had diminished in number because of racial mixing by the 18th century which also coincided with this gradual recuperation of the native population.

At the end of the sixteenth century the indigenous population was in decline; the European and African populations, on the contrary, increased by immigration, voluntarily or as slaves and by their own reproduction. It is estimated that between 1568-1570 and 1646 the number of Europeans in new Spain doubled that of Afro-descendants tripled and that of mestizos multiplied by seven while the indigenous population on the other hand was reduced by half (Cook and Borah, 1974).

Towards the middle of the 18th century, regional differences in racial composition are already being pointed out: the predominantly indigenous population in the central region was no longer in the northern part; at the same time there was a relative concentration of the black population or "pardos", on the central coasts. For the year 1753, on the instructions of Juan Francisco de

Guemes, first count of Revillagigedo, the first census of population in the city of Mexico is realized where the caste to which belongs to the population of the capital is documented for the first time. Between 1789 and 1793 Jose Menendez Valdes, visitor of the Viceroy compiles the description and general census of the intendancy of Guadalajara (Cook and Borah, 1974). According to these figures, it is estimated that the Afro-descendant population constituted 5% of the population.

The 20th century is when research into Afrodescendant Mexicans began to be carried out with the states having the highest prevalence of these communities being identified. The communities which are today regarded as having the largest Afrodescendant Mexican populations are Veracruz, Guerrero and Oaxaca, although, there are also some regions in Coahuila, San Luis Potosi, Michoacan, Morelos and Guanajuato with substantial black populations (Anonymous, 2006).

Unfortunately and despite the first stirrings of interest in the theme, recognition of the presence and heritage of Afrodescendant Mexicans is still in its infancy, leaving much to be done in terms of research into and understanding and recognition of the contributions of this group to the culture of the region (Pineda, 2016). It is necessary therefore to undertake further investigation into the topic in order to shed light on the past and the roots of the Afrodescendant Mexican population and this has been the inspiration for this study.

**Case study:** Study of the mitochondrial genome is an extremely useful tool for bioanthropological research as it allows, through identification of the matriarchal line, for the identification of the development and characteristics of individuals as well as population dynamics and other evolutionary aspects (Pakendorf and Stoneking, 2005). The first studies undertaken in populations from the Americas allowed for the identification of the four principal groups which today characterize the human origins of the American continent. Studies of DNA have focused on populations with the supposed Amerindian ancestral component but nevertheless, in countries such as Mexico which form part of the region, the characteristic racial mixing can present a research challenge as genetic structure is to a large degree, ignored and the study of the mitochondrial genome and other molecular markers is very limited (Green *et al.*, 2000).

The information in this study is based on that contained in the Genbank, the most comprehensive free-access database which currently exists and which contains the mitochondrial sequences of the four haplogroups present on the American continent. The haplotypes of the 14 indigenous Mexican groups

published by Penaloza-Espinosa *et al.* (2007) are used as a frame of reference. In order to explore the prevalence and distribution of these distinct haplogroups and their related haplotypes in the Mexican population, a search of complete mitochondrial chromosomes was designed based on information from the Nucleotide NCBI database in 2017.

Once the sequencing information had been obtained, the metadata was reviewed in order to validate geographical origin and eliminate information relating to historical groups of humans or those whose ethnic group is not identified. At the end of this process 268 sequences were obtained which could be used as samples for this study. This information allowed us to access the complete mitochondrial genome sequences of the Mexican population in the database, using the genome navigator of the University of California Santa Cruz (Anonymous, 2017a) to align these sequences with those used for reference. The haplotypification of the sequences was carried out using the MITOMASTER which allowed a database to be generated for tabulation and statistical analysis purposes (Anonymous, 2017b).

**Analysis of results:** After carrying out the haplogroup analysis there was found to be a clear predominance of groups of native indigenous descent, with a slight tendency towards a mixed-race population. The most common subclass is comprised of Aztec-related groups which is to be expected as the Aztec population was widely distributed throughout Mesoamerica for a prolonged period (Mata-Miguel *et al.*, 2012). The most infrequent markers were those related to haplogroups originating in North Africa, the Near East and the Caucasus and north-eastern Europe. The presence of these haplogroups corresponds without doubt to the colonization of the Iberian Peninsula by Muslim groups and their subsequent mixing with Europeans (Maca-Meyer *et al.*, 2001). Another interesting marker is one frequently found in groups of Jewish origin, indicating the probable migration of these groups during the colonization of the region by Spain and which is most commonly identified in the northernmost states of the country (Bedford *et al.*, 2013).

A factor which is fundamental to this study and one which is in fact the motivation behind it is the extremely limited representation of African-characterized haplogroups in the databases, a factor that could be due to the lack of adequate markers permitting such groups to be identified. This is an important point to mention as a significant area of Mexican territory is inhabited by individuals with a marked afrodescendant phenotype, indicating a lack of sufficient depth in the population studies carried out with these groups. According to

Green *et al.* (2000) afrodescendant populations in the country have not been researched and as a result are given little consideration by these studies.

## RESULTS AND DISCUSSION

Health-focused research can benefit society in many different ways, as it leads directly to the production of pharmaceuticals, vaccines or medical devices or indirectly, to the proposal and planning of public health policies which promote the development of environments designed to improve the wellbeing of the population (Lewison, 2008). It is vital therefore that these improvements are based on recognized, high-quality and in-depth research processes which take into account significant quantities of cases and information with the intention of producing studies which really represent the majority. However, what happens when as can be appreciated in the above case this does not actually take place?

According to Article 27 of the Universal Declaration of Human Rights, every person has the right to participate in scientific progress and the benefits which result from it. However, in order for this to actually happen, it is necessary for every person to be considered part of a group of interest in previous studies (Anonymous, 2017c).

Unfortunately, although it is recognised that scientific development comprises one of the most important elements for growth and the generation of value, scientific achievements are not necessarily inclusive of those who need them most and repeatedly focus on the same population groups and those groups considered most privileged. Unequal political, social and economic development goes hand in hand with unequal access to scientific and technological benefits, exacerbating the differences between the groups and helping to create an ever-widening regional divide (Anonymous, 2015).

According to the UNESCO Use of Science report, the Science Declaration and the World Science Report, there is a clear polarization of knowledge, one that is concentrated in the dominant centers of Europe and the United States. In addition, this signifies that scientific and technological advances are increasingly oriented towards private enterprises rather than the public sphere, marking a clear tendency towards the privatization of knowledge (Anonymous, 1999). This reality inevitably further segregates those who are already marginalized and gives greater benefit to those who already have most.

It does not appear therefore that the current dynamic of scientific development seeks to benefit human need which should be its *raison-d'être* but is focused towards the requirements of the production sector and specific

groups who do not necessarily comprise the majority (Anonymous, 2015). This investigation highlights this phenomenon in Mexico, where there is a significant lack of information about a large part of the population.

Currently however organizations such as Anonymous (2011) (National Council for the Prevention of Discrimination in Mexico) are beginning to turn their focus towards those of African descent, although this is serving to highlight even further the sad reality of the discrimination suffered by members of this group and to reinforce the prejudices that the general population has towards them. Despite some afrodescendant groups in Mexico seeking to heighten their profile and struggling for recognition in different areas of society they continue to be identified by the majority of studies as simply being of mixed race, although according to the National Institute of Statistics and Geography (INEGI) they comprise 1% of the national population (Anonymous, 2017).

## CONCLUSION

**Final considerations:** This study has sought to reflect on the clear discrimination experienced by the Afrodescendant community in Mexico and highlighted the extent of this segregation, including the lack of attention given to the group in the statistical studies carried out by research organizations in the country. It is unfortunate that, despite the commitment of the Mexican government to guaranteeing equality and universal access to healthcare, little has been done to include Afrodescendants in public policy, nor is the group even recognized as one which needs to be taken into account (INEGI, 2017).

The lack of understanding about the contribution of Africans and their descendants to the society and history of the region can be appreciated in the exclusion traditionally experienced by the group in a society which only recognizes two Mexican cultural roots: the indigenous and the European. Despite the presence of historically significant individuals with Afrodescendant backgrounds such as Gaspar Yanga or those of Afro-mestizo Descent such as Jose Maria Morelos and Vicente Guerrero, Mexican history appears to give little or no importance to this group (Velazquez and Iturralde, 2012).

The black community in Mexico is demanding to be recognized as part of Mexican culture and the Mexican population and to be considered as one of the living roots of national history in the same way as indigenous groups or the European influence which has been so lauded at different moments in history (Gargallo, 2005). When confronted with today's reality of multiculturalism and globalization, it is necessary to eliminate the prejudices

which widen the differences between people and incorporate all groups in the development of public policies which are integral and inclusive (Anonymous, 2011).

Health is a human right that should be available to all and thus the information necessary for the development of the country in the areas of health sciences needs to be made available. If real and inclusive understanding cannot be guaranteed then scientific advances are only being partially made and only benefit those who already have the most and who are as can be appreciated from this study, considered most socially and culturally relevant.

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