



# Disparity in Populace Phenotype Impels Predisposition to Variations in Health Status

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## Abstract

**Background:** The disparity in populace phenotype, embracing stature and pigmentation, drives of internal physiological constituent and adaptation to the external environment, impel variations in populace health status. The study tends to explore how significantly populaces phenotype influenced by internal or external exposures, and how effectually it prognosticates predisposition to variant health states.

**Methods:** Ecological study encompassing twenty states residing on antipodes (North and South) endures distinct exposures, exhibit disparate phenotypes, execute different health status. Each State selected employing non-proportion quota sampling, standing extreme on either stature or pigmentation, residing in cold or hot region, contrasted on considered variables embracing UV-index, malnutrition, healthy life expectancy, fertility rate, natural increase, and top five causes of mortality. All computation, analysis, and interpretation perform employing MS-EXCEL. The complete compilation phase last from March to June 2019.

**Results:** Findings reveal a strong association between exposures and phenotypes, UV-index and pigmentation ( $r = 0.96$ ), malnutrition and stature ( $r = -0.81$ ). Stature descends and pigmentation ascends along the latitude (North to South). Populace light pigmentation tall stature executes healthy prolong life span contrast to deep pigmentation standing short. Cardiac and cancer diseases significantly reported among statured nations. While high susceptibility to Influenza/ Pneumonia, and HIV/AIDS observe in pigmented nations.

**Conclusion:** Decisively homo sapiens phenotypes inordinately servile to internal and external exposures effectually prognosticate predisposition to distinct health states. Enforcement of measures mitigating populace internal and external exposure can elicit desire output in phenotype and outcomes in health status.

**Keywords:** Stature, pigmentation, healthy life expectancy, UV index, malnutrition

## Introduction

Health degeneration is a growing global concern. About four-fifths of the world populace execute life span less than seven decades. Health status is briefly defined by

birth rate, death rate, and healthy life expectancy, likely to vary across the globe. (1)

People phenotype characterize by stature, pigmentation, mass, (2) drives of an internal physiological constituent, and adaptation to the

external environment. Populace dwelling in a region, abide by intense UV radiations, assumes deep pigmentation (3). In contrast, the nations in territories bearing low UV-index, reveal light pigmentation. (4) The increase reliance on healthy regimen, including the salubrious nutrition, concomitant tall standing on stature whereas malnutrition account for short stature. The differences in these phenotypes determine the susceptibility or insusceptibility to varied benign and malignant disease. The high melanin induces low sensitivity to heat and cold. (3) Light skin administers adequate Vit D concentration at site of UV exposure, reduce susceptibility to various fatal diseases. (4) The short statures exhibit short pathways turn more responsive to external stimuli are less afflicted by chronic diseases. (5) While tall standing steers low vulnerability to respiratory issues. (6) Thus, each phenotype precursor some health pros and cons. This study tends to expatiate the disparities in populace phenotype, embracing stature and pigmentation, ensues of internal or external exposure, and considering the differences prognosticates predisposition to variant health states.

## Methodology

The ecological study encompasses twenty states residing on antipodes (North and South), endure distinct exposures, exhibit disparate phenotypes, and execute variant health status.

Each State selected employing non-proportion quota sampling, standing extreme on either stature (measures mean of two genders in cm ) or pigmentation (estimated using a chromatic color scale) (7) residing in a cold or hot region, contrasted on considered variables embracing UV index (uv), malnutrition (m), fertility rate(fr), natural increase (ni, difference of birth rate and death rate) (8), healthy life expectancy, and top 5 causes of mortality(by %), reflecting populace succinct health profiles.

Calculation of correlation coefficient, stature, and pigmentation assessed against malnutrition and UV index respectively. Equation of multiple regression formulated, stature, and pigmentation along with estimator prognosticate healthy life expectancy. Compliance to phenotypes each considered variable statistically analyzed whereas the top 3 causes of mortality shortlisted by multiplying assign weight 5 to 1 in descending order to the frequency of occurrence.

Also, the most critical causation of mortality assessed in relation to phenotypes.

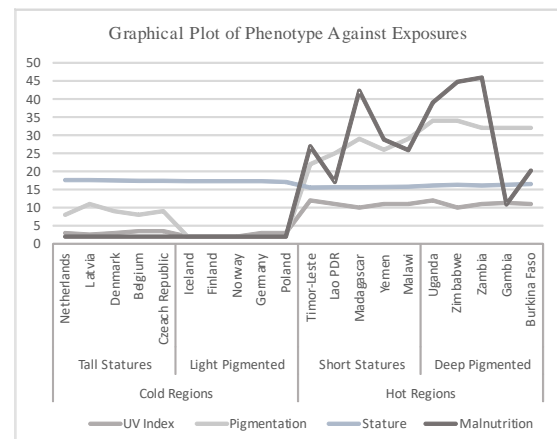
Study wears the essence of both qualitative and quantitative research. Derive most figurative data of four main sources including World life expectancy, (1) NCD-RisC,( 9) Human Displacement Map of the World, (10) Weather Atlas, (11), FAO,(12) offering ease of accessibility, availability, and accuracy.

Perform all computation, analysis, and interpretation employing MS EXCEL. The complete compilation phase lasts for 4 months dated March to June 2019. Relatively smaller sample size bearing 10% (20) representation for entire world states 100% (195), disproportion sampling along with embedded selection bias, considering only tall or short stature, dark or light pigmentation, residing in the cold or hot region, ignoring the other possibilities, are some limitations to generalization.

The study intends to seek responses to the following research question:

How significantly populace phenotype influenced by internal or external exposure?

How effectually populace phenotype prognosticate predisposition to variant health states?



**Figure 1. Note: Height(cm) is adjusted by dividing with 10, Malnutrition for cold region exist below 2.5.**

## Results

The cold climates mostly concentrate by nations endure low UV index ( $uv_{avg}=3$ ) comrade's light pigmentation, administers healthy nutrition ( $m_{avg}=2$ ) ensure tall standing on stature. In contrast, hot sunny region resides by nations, bear intense UV radiation ( $uv_{avg}=11$ ) exhibit tan to dark pigmentation, excessively

report malnutrition ( $m_{avg} = 30.5$ ) reprehensible for low to moderate standing on stature. Findings indicate a strong correlation between UV index and pigmentation ( $r = 0.96$ ), malnutrition and stature ( $r = -0.81$ ) (Figure 1) Stature likely to descend and pigmentation ascend along the latitude from North to South.

**Table 1. Estimating Healthy Life Expectancy**

Regression Analysis				
Healthy Life Expectancy = $39 + 0.2 \text{ Stature} - 0.5 \text{ Pigmentation}$				
Multiple R	0.98	Adjusted R Square	0.95	
R Square	0.95	Standard Error	1.8	
Computed F:180	Critical Value of F: 3.59	Significance of F: <0.00		

Stature positively ( $t = 2.13$ ,  $t(0.025) = \pm 2.11$   $p < 0.05$ , C.I = 95%), pigmentation negatively ( $t = -9.03$ ,  $t(0.025) = \pm 2.11$   $p < 0.05$ , C.I = 95%) associates healthy life expectancy. (Table 1) Populace light pigmentation high standing on stature often execute healthy prolong life span of 7 decades contrast to 5 decades by deep pigmentation standing below mean stature. (Table 2, Table 3)

Mean fertility rate apparently high among deep pigmented ( $fr = 5$ ), short stature ( $fr = 4$ ) populaces than light pigmented ( $fr = 2$ ) tall statures ( $fr = 2$ ). Approximately 56% high fertility rate in hot than cold regions.

**Table 2. Cold Region Populace Succinct Health Profiles**

SELECTED STATES	STATURE (cm)	PIGMENTATION	HEALTHY LIFE EXPECTANCY	FERTILITY RATE	NATURAL INCREASE RATE (%)	TOP FIVE CAUSES OF MORTALITY					DISEASE ABBREVIATION	
						(Assign Wg x Frequency of Occurrence)						
						5	4	3	2	1		
ALD												
Alzheimer's/Dementia												
CHD												
TALL STATISTICS	Netherlands	176	8	72	2	0.2	CHD	ALD	Lu C	S	LD	Coronary Heart Disease
	Latvia	176	11	67	2	-0.5	CHD	S	Lu C	CR C	I/H	CR C
	Denmark	175	9	72	2	0.0	CHD	LD	Lu C	ALD	S	Colon-Rectum Cancers
	Belgium	174	8	72	2	0.2	CHD	ALD	S	Lu C	LD	H
	Czech Republic	174	9	69	2	-0.1	CHD	S	Lu C	LD	CR C	Hypertension
Mean	175	9	70	2	-0.04	CHD	S	Lu C			I/H	
LIGHT PIGMENTED	Iceland	173	2	73	2	0.7	CHD	ALD	S	Lu C	LD	Inflammatory Heart
	Finland	173	2	72	2	0.1	CHD	ALD	S	Lu C	CR C	Lu C
	Norway	173	2	73	2	0.4	CHD	ALD	S	LD	Lu C	Lung Cancer
	Germany	173	2	72	2	-0.3	CHD	S	Lu C	LD	ALD	LD
	Poland	171	2	69	1	-0.9	CHD	S	Lu C	ALD	I/H	Lung Disease
Mean	173	2	72	2	0	CHD	S	ALD			S	
											Stroke	

Source: World life expectancy, 2017 \*, NCD-RisC, 2016\*, Human Displacement Map of the World, 2008\*.

The estimated population growth rate, strikingly high among deep pigmentation ( $ni_{avg} = 2.8$ ), short heights ( $ni_{avg} = 2.5$ ) and alarmingly low in light pigmentation

( $ni_{avg} = 0$ ), tall statures ( $ni_{avg} = -0.4$ ). The manifestation of clear inclination in natural increase observes among the nations from north towards south. (Table 2, Table 3)

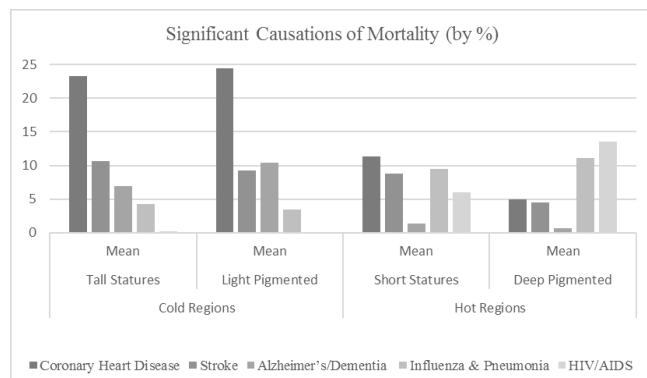
**Table 3. Hot Region Populace Succinct Health Profiles**

SELECTED STATES	STATURE (cm)	PIGMENTATION	HEALTHY LIFE EXPECTANCY	FERTILITY RATE	NATURAL INCREASE RATE (%)	TOP FIVE CAUSES OF MORTALITY					DISEASE ABBREVIATION	
						(Assign Wg x Frequency of Occurrence)					A	
						5	4	3	2	1	Accident	
HOT REGIONS												
SHORT STATURES	Timor-Leste	155	22	59	5	2.8	TB	I & P	CHD	S	BT	BT
	Lao PDR	156	25	58	3	1.6	CHD	S	I & P	TB	Li C	Birth-Trauma
	Madagascar	156	29	58	4	2.5	I & P	S	TB	DD	CHD	DD
	Yemen	157	26	55	4	2.2	CHD	S	I & P	LBW	A	Diarrheal Disease
	Malawi	158	29	56	6	3.3	AIDS	I & P	DD	M	CHD	I & P
DEEP PIGMENTED	Mean	156	26	57	4	2.5	I & P	CHD	S			Influenza & Pneumonia
	Uganda	161	34	55	6	3.3	AIDS	I & P	DD	M	S	Li C
	Zimbabwe	163	34	54	4	2.4	AIDS	I & P	A	DD	LBW	Liver Cancer
	Zambia	161	32	54	6	2.9	AIDS	I & P	DD	M	CHD	LBW
	Gambia	163	32	54	4	2.2	I & P	AIDS	S	CHD	LBW	Low Birth Wg
Mean	Burkina Faso	165	32	53	6	3.0	I & P	M	DD	CHD	LBW	M
	Mean	163	33	54	5	2.8	I & P	AIDS	DD			TB
											Tuberculosis	

Source: World life expectancy, 2017 \*, NCD-RisC, 2016\*, Human Displacement Map of the World, 2008\*.

Coronary Heart Disease, Stroke, Alzheimer's/Dementia, significantly contributes to mortality among light pigmented tall nations residing in cold regions. While high mortality excessively ensues of Influenza and Pneumonia, HIV/AIDS, Coronary Heart Disease, Diarrheal Disease among short stature swarthy occupying hot territories. (Table 2, Table 3)

A comparison of significant causation of mortality based on phenotype considerably corroborates the above findings. (Figure 2) coronary heart disease and Stroke, reprehensible for 52% and 18% greater mortality in tall stature than nation standing short. Alzheimer's/Dementia execute critical figures in Caucasians, 50% high than deeply pigmented nations. While HIV/AIDS is considerably conspicuous in swarthy, 100% above than lightly pigmented nations. Influenza and Pneumonia afflict a large proportion of populaces, report 73% greater fatalities in deep pigmentation than light, and 56% greater in short than tall statures. (Figure 2)



**Figure 2. Comparison of significant causation of mortality based on phenotype**

## Discussion

The disparity in populace phenotypes embracing stature and pigmentation ensues of internal physiological constituent and adaptation to environmental exposure, impel predisposition to distinct health states. Usually, nations enduring cold climes, administer healthy regimens, execute tall stature, and light pigmentation, in contrast to nations occupying the hot tropical region, suffer high UV index and malnutrition, stands low to moderate on stature and tan to dark on pigmentation.

The European States, light pigmented tall stature nations embodying Netherland, Iceland, Switzerland executes prolong disease-free life span (Healthy life span >70 yrs.) whereas Malawi, Sierra Leone, Zimbabwe, deep pigmented short stature African States live far below the mean life expectancies (Healthy life span <60 yrs.). (9,10) The former States experience 3 times fewer fatalities than the later States. (13)

Globally, Netherland males and Latvia females stand tallest while, Timor-Leste males and Guatemala females stand shortest on stature.(6) The estimated average height for the world population is 1.65m, 1.71m in males, and 1.60m in females.(14) Mean male stature (1.71m,  $\pm 0.02$ ) constitute of 44% tall(>1.73m), 30% intermediate (1.69m to 1.73m) and 26% short (<1.69m) individuals.(14) Similarly mean female stature (1.60m,  $\pm 0.02$ ) derive of 39% tall (>1.62m), 32% intermediate (1.58m to 1.62m) and 29% short (<1.58m) individuals.(14) Tall statures mostly concentrate in cold European states while short in hot Asia and Africa.

Growth hormones stimulate cartilages reprehensible for musculoskeletal configuration attributes tall or

short statures. Healthy nutrition and nourishment strongly determine growth hormones secretion, about 88% to 99% of height features are hereditary while 20% to 40% modified by healthy regimens. (15) Every extra intake of 100 kcal in the early eighteen years facilitates 0.03 inches increase in stature. (15)

Finland, Latvia, Netherland significantly inhibits malnutrition, secure tall stature while Central African Republic, Sierra Leone, Madagascar characterizing African territories, suffers extreme, stand below mean stature. (12) Poor nutrition one major cause foments height retardation, afflicts every one-third child in Sub Saharan Africa and reprehensible for 33.2% of stunting. (16).

Whereas the levels of growth hormone and cell proliferation positively associate cancer rates. (17) Estimated 20% to 40% increased risk of developing cancer among tall statures, (6) Every 10cm height above-average supplement risk of cancer by 11% in males and 18% in females. (18) Also, 10cm increase in stature accompany risk of lung cancer, 9% in males and 4% in females. The finding particularly significant in European and Asian territories. (19) The increasing number of mortalities accruing among tall stature nations including Netherland, Denmark, Serbia, corroborate the sufferance of Lung Cancer. (1)

Venous Thromboembolism (VTE), 2.57 times more frequently encountered in tall statures, (18) every 10 cm above average height comrades 30 to 40% increase risk in long lower limbs withstands high gravitational forces resisting venous flow.

The study suggests tall statures with large venous pathways, surface area, and hydrostatic pressure excessively prone to atrial fibrillation. (20) Results high incidence of stroke and heart disease. (18). Coronary heart disease, convicts large proportion of tall populaces, reports strikingly higher mortality rates in Ukraine and Belarus, 0.33 and 0.31 per 100 individuals each measure 1.7 m tall (1,9)

In contrast, short statures appear more vigorous, process sensory signal 10 sec earlier than tall individuals. (5) Standing below mean stature complement low sensitivity to sun radiations, the rapid discharge of heat, less vulnerability to heatstroke, experience 20% less susceptibility to skin cancer. (6) Short stature comrade's greater stability in the functionality of vital organs with advances in age. Females standing low on stature, with small body configuration often vulnerable to short gestation, pre and post-pregnancy complexities. (6) Administers

twice the fertility rate than tall females in some continents prone to menopausal issues, breast, and ovary cancer (6)

The world population constitutes approximately 16% Caucasian and 15% Swarthy. (21) Swarthy occupies hot African territories enduring intense UV exposure than Caucasians residing mostly in the cold European region. Accordingly, Uganda, Zimbabwe execute the deepest pigmentation whereas Iceland, Finland the lightest. (10) Pigmentation determines the proportion of eumelanin and pheomelanin. An increased proportion of eumelanin ensues deep pigmentation while pheomelanin responsible for light pigmentation. The proportion of these pigmentations often correlate with UV exposure. (22) Skin pigmentation observes between 1 to 36 on the chromatic color scale reflects shades of lightness (1 to 12), tanned (12 to 24), and darkness (24 to 36). (10)

Melanin exhibits a significant role in regulating each basic unit of life, cells constituting the entire human body. The concentration of melanin facilitates the synthesis of energy through water dissociation independent of vascular pathways. Derive energy ensures the functionality of vital organs and systems. (23)

Pigmented skin rich in melanin, meant to boost immunity against a host of disease. Endure high resistance to parasitic infection, induce low sensitivity to heat and cold. (3)

Pigmentation comrades' lower rates of visual impairment. Confronts lower issue of temporary hearing loss accruing of noise exposure. (3) Impels low rates of osteoporosis than Caucasian. Deep pigmentation triggers 50 times reduce risk of developing cancer among swarthy. (3)

Pigmentation less prone to a neurological disorder. A study incorporating 122 subjects report 50% greater prevalence of Alzheimer's in Caucasians than Swarthy. (24) CNS extensively submissive to melanin for effective regulation, accounts for high Alzheimer related mortality rates (per 1000) in lightly pigmented nations embracing Turkey (0.58), Lebanon (0.56) Libya (0.53) Finland (0.51). (1,10)

Vit D derivative of UV exposure, essential for healthy nourishments, execute an autoimmune response to infection, help prevent the incidence of fatal and non-fatal disease. Light pigmentation more responsive to UV exposure, trigger 50k IU Vit D within 30 min of sunbath than 8k to 10k IU by deep pigmentation. (4)

On the other hand, inordinate melanin, natural sunscreen, often inverse Vit D production reprehensible for Vit D deficiency. Reportedly 53% to 76% of dark pigmented nations frequently found deficit in Vit D concentration, residing close to the equator. (25)

The presence of the Vit D receptor in each body cell signifies the role of Vit D in the regulation of physiological processes. Vit D inadequacy result increase risk of TB, hepatitis C virus, and AIDS criticality. (26)

HIV/AIDS, intimate association with Vit D deficiency, targets large populaces in regions, bearing pigmentation indices above 27 on chromatic color scale, including Lesotho (0.58), Swaziland (0.38), Mozambique (0.3), Zimbabwe (0.28), report high mortality rate per 100 individuals. (1,10)

Influenza leading causation of mortality globally inflicts 0.2 to 0.6 million people annually. (27) Vit D deficiency entices twice Influenzas and pneumonia-related mortalities in children exhibiting dark pigmentation. (28) Most conspicuous figures observed in pigmented nations, Nigeria, and Sierra Leone, report highest mortality rate (100), 0.25 and 0.22, respectively. (1)

Vit D insufficiency, also held reprehensible for increased incidence of diarrheal diseases. (29) The 8<sup>th</sup> leading causation of global mortality in all age groups. Significantly higher fatality rate (per 100) observes in nation abide by high pigment indexation, among youngster in Chad (0.5), Central Africa (0.38) and Niger (0.38) whereas oldster in Kenya (1.9) and Central African Republic (1.3). (30)

Natural increase is conspicuous in hot regions than in cold territories. The estimated natural increase in Swarthy is approximately 100% above the Caucasians.

(1) Deep Pigmentation executes a 60% high fertility rate than light pigmentation. (1) The observe birth rate in African territories equals 4 to 5 times the death rate, whereas European States experiences the inverse. (1)

The study selects only a few States exhibiting desired characteristics subjects to limitation. Have ascertained more significant finding considering a large sample size, employing random sampling, and avoiding selection bias.

A study considering the above finding tends to propound interventions steering the foremost approach towards preventive care. Embraces health investments conforming populace early age nutrition

and nourishment requisites, ensuring desired later age health benefits.

## Conclusion

The health states inordinately servile to phenotypes, the stature and pigmentation, derives of internal and external exposures. The prolong healthy life span, associates positively and pejoratively to stature and pigmentation, respectively.

The increase vulnerability of statures to cardiac and cancer diseases, while pigmentations prone to influenza/pneumonia, and HIV/AIDS.

Enforcement of measures mitigating populace internal and external exposure can elicit desire output in phenotype and outcomes in health status.

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