

Psychometric Assessment of Human Life History Predicts Health Related Behaviors

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Abstract

Life History Theory is a powerful framework that can help promote understanding of variation in health-related behavioral patterns and why they vary consistent with environmental conditions. An organism's life history reflects tradeoffs made in the allocation of effort towards specific aspects of survival and reproduction across the lifespan. This study examines the relationship between psychological indicators of life history strategy and health related behaviors in a demographically representative sample in the Midwestern USA. Slower life histories predicted higher levels of health promoting behaviors and lower levels of health adverse behaviors, even when controlling for relevant socio-demographic factors. The analyses provide a strong test of the hypothesized relationship between life history and health behavior indicators, as life history variation co-varies with these socio-demographic factors. Traditional public health efforts may be reaching their limits of effectiveness in encouraging health-promoting behaviors. Integrating an evolutionary framework may revitalize behavioral health promotion efforts.

Keywords: Life history, health, health behavior, evolution

Introduction

Human health and longevity have improved dramatically in technologically advanced societies due to scientific research and intervention. Advances in health and medical technologies continue to extend the possibilities of saving lives.

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However, efforts to promote healthy behaviors and discourage health adverse behaviors struggle with diminishing returns. Health related research is broad in scope, diverse in activity, and fragmented theoretically, methodologically, and across disciplines. The pace of progress in understanding and improving human health would be accelerated greatly by establishing a universal and deep framework for understanding and integrating disparate undertakings. This framework is evolutionary theory, the most powerful explanatory system in the life sciences and the only framework that can unify knowledge in otherwise disparate fields of human research. Within evolutionary theory, Life History Theory in particular holds the promise of promoting understanding of variation in behavioral patterns related to health and why they vary consistent with environmental conditions.

Life History Theory and Human Health

Life History Theory (LHT) is a powerful framework providing an understanding of systematic variation in behavior and physiology in terms of functional adaptations to environmental conditions. Life history strategies reflect tradeoffs in the allocation of effort towards specific aspects of survival and reproduction across the lifespan (Chisholm, 1999; Roff, 1992; Stearns, 1992). This framework may be useful for understanding human tendencies for health promoting and health adverse behaviors, which are prominent factors in the most prevalent causes of mortality today in modernized nations, including cardiovascular diseases, cancer, and diabetes (Centers for Disease Control and Prevention, 1999).

In evolutionary terms, life history strategies are not inherently "good" or "bad", as a range of strategies have proven successful given the appropriate environmental conditions. As a species, all humans are strongly K-selected, so individual variation occurs within the slower range of the continuum (Low, 1998). Public health professionals may value characteristics of slower human life history strategies as good or desirable, as slower life history is associated with greater relationship stability, higher investment in children, lower impulsivity, lower levels of risk taking, and greater regard for social rules (Figueredo et al., 2006).

Short time horizons, substantial future discounting, and risky behaviors contribute to a wide variety of health issues, concerns, and outcomes. The future-oriented strategies that health promotion efforts encourage depend on environmental conditions that will be relatively stable over time. Individuals developing in relatively less predictable environments will exhibit riskier, immediate outcome oriented, behavioral strategies because of the historical low probability of reproductive success for more cautious approaches (Hill, Ross, & Low, 1997; Wilson & Daly, 1997). In unstable ancestral environments, the most pressing adaptive problem faced by individuals was avoiding death. Risky behaviors by definition have uncertain outcomes, but in aggregate, they facilitated early reproduction before death occurred. Those living in chronically uncertain environments are more likely to experience

earlier menarche, earlier ages of reproduction, and higher reproductive rates (Chisholm, 1999; Kim, Smith, & Palermi, 1997).

Community college students in the USA who had higher estimates of future unpredictability and lower expectations for their lifespan had a higher frequency of risk-taking (Hill et al., 1997). Homicide rates across Chicago neighborhoods correspond with neighborhood life expectancy and neighborhood income inequality (Wilson & Daly, 1997).

Mischel and colleagues demonstrated how future-oriented self-control predicts a wide range of outcomes including social competence, educational achievement, and resilience to frustration and stress (e.g., Mischel, Shoda, & Rodriguez, 1989). Individuals' time perspectives (encompassing time horizons, future discounting, planning, etc.) may be central to the psychological representation of life history tradeoffs. Future orientation (low future discounting, etc.) reflects a pattern of behavior dominated by a striving for future goals and rewards.

Longer-term, lower risk, behavioral strategies are expected among those who have experienced reliably stable and supportive environments. Others who experienced environments where personal safety, social support, and resource control are uncertain may be more likely to discount future benefits in favor of more immediate rewards. Indeed, a more supportive socio-developmental environment (in terms of perceptions of physical safety, positive socialization, and the helpfulness of others) predicted the strength of future-orientation and inversely predicted present orientation in US inner-city middle school students (Kruger, Reischl, & Zimmerman, 2008). Present orientation predicted both interpersonal aggression and illicit exploitation of resources; future orientation also inversely predicted interpersonal aggression uniquely. A similar model of time perspective based on life history theory may also explain and predict substance use behaviors better than conventional models (Richardson & Hardesty, 2012).

Both boys and girls exhibit risky behaviors, yet there are considerable sex differences on average in both the prevalence and danger of these behaviors. The peak of risky behaviors observed in young adulthood corresponds with entrance into mating competition (Wilson & Daly, 1992). Males compete for social status and resource control, as these are characteristics valued cross-culturally in intersexual selection (Buss, 1989) and predict reproductive success across a wide variety of societies (Hopcroft, 2006). In ancestral times, men who controlled more resources mated with younger women, mated with more women, and produced offspring earlier (Low, 1998). The psychological system underlying the risky behavioral patterns of young men was selected for because these behaviors tended to aid in mating competition in ancestral environments. The shifts in the male allocations of effort from somatic to mating to parenting over the life course help to explain the patterns of risky behaviors underlying the peak in sex differences in mortality from behavioral causes during young adulthood, followed by rates that decline across adulthood but never reach female levels (Kruger & Nesse, 2006).

Evolutionary Theory in Health Research

In an evolutionary theoretical framework, the health sciences are complementary to behavioral and social sciences focusing on other topics, all of which should converge in a larger empirically driven account of human psychology, behavior, and emerging health and social patterns. Given the power and scope of the evolutionary framework as foundation for human science, why is evolutionary theory nearly absent from health behavior research? This is likely in part to misconceptions such as the naturalistic fallacy and perceptions of genetic determinism that are impediments to evolutionary approaches in general. More specifically, health researchers and practitioners may resist the application of evolutionary theory to their field because of the widespread aversion to the eugenics movements that shaped public health efforts in the early 20th century. Eugenics programs were promoted by prominent figures such as H.G. Wells, Margaret Sanger, John Maynard Keynes, and W.K. Kellogg. These programs ranged widely from family planning and prenatal care programs for mothers to forced sterilization and state laws banning interracial marriage. After the revelation of genocides committed by Nazi Germany, which utilized propaganda with arguments loosely based on eugenic principles, eugenics was considered unacceptable and efforts to understand human behavior in the context of evolutionary selection pressures were controversial. When evolutionary approaches to understanding human behavior were revived in the 1970s, radicals in the ongoing culture wars believed they advocated racism, eugenics, and genocide simply for stating that human behavior was not solely determined by socialization and culture, but could also be genetically influenced (Seegerstråle, 2000).

Thus, it is critical to emphasize the differences between modern evolutionary health research and historical attempts to create selective breeding programs. First, modern evolutionary health research seeks to improve the health of individuals, rather than establish or maintain some imagined ideal population. Evolution is not teleological, there is no ideal Platonic form of human, and genetic diversity is crucial for selection and resilience in the face of ecological and environmental changes. No individual or group of people is more highly evolved than any other individual or group of people. Everyone who is alive today is descended from a very long line of successful ancestors. Life History Theory in particular is a refutation of genetic determinism, as phenotypic plasticity and reaction norms result from the complex interaction between genetic inheritance and developmental environment.

Darwinian Medicine (e.g., Nesse & Williams, 1994) has already made considerable progress in the practical understanding of human physiology and other areas informing medical care. Evolutionary approaches to understanding health behavior are more recent, though the momentum appears to be building as demonstrated by the increase in research literature (e.g., Hill, Rodeheffer, DelPriore, & Butterfield, 2013; Kruger, Clark, & Vanas, 2013; Pepper & Nettle, 2014). The

establishment of the International Society for Evolution, Medicine, and Public Health in 2015 will hopefully accelerate this progress.

Hypotheses

Slower life histories are expected to correspond with high levels of health promoting behaviors and lower levels of health adverse behaviors, even when controlling for relevant socio-demographic factors. We intend to demonstrate how a life history perspective advances the understanding of variation in health behaviors beyond current conventional models. The standard academic Public Health framework depicts individuals as interchangeable, differences in health outcomes are due to social forces based on social identities (known as the Social Determinants of Health), and social status. The health impact of the social status gradient and socio-economic inequality is now well known (Marmot, Kogevinas, & Elston, 1987), though the relationship of status gradients with reproductive skew is rarely mentioned. We provide a test of the predictive power of a common psychometric life history assessment compared to standard socio-demographic indicators for understanding variation in health behaviors in a diverse, demographically representative sample in the Midwestern USA.

Method

This study utilized data from the 2009 and 2011 waves of a demographically representative county-wide health survey in Genesee County, Michigan, in the Midwestern USA.

Genesee County's urban center of Flint is an industrial city whose economy and population has followed the manufacturing capacity of the city's largest employer, General Motors. The county contains urban, suburban, and rural areas and there is considerable socio-economic variation. The survey sample was developed based on randomly selected records across all residential Census Tracts from address lists provided by the US Post Office. Telephone landline numbers were merged with these records, when available, based on data from Marketing Systems Group. Mailed pre-notification letters informed residents about the Community Survey. The 2009 survey data were obtained through a Computer Aided Telephone Interview (CATI) with a professional interviewer. The 2011 survey could be completed in three ways: as a mailed hardcopy (send in a Self-Addressed Stamped Envelope), a Qualtrics™ survey on the Internet, and as a CATI. The letter noted that the survey provided multiple options for completion and contained a link to the on-line survey website. The response rate was 25%.

The survey included standard health behavior items from the Behavioral Risk Factor Surveillance System (BRFSS; Centers for Disease Control and Prevention, 2011). These included items on moderate and vigorous exercise (converted into minutes of exercise per week), fruit and vegetable consumption (converted into fruit and vegetable servings per day and a binary indicator of whether participants consumed the recommended five or more servings per day), tobacco smoking status, total alcohol consumption (converted to alcoholic drinks per month) and whether the participant was a binge drinker (consuming five alcoholic drinks at one time for men, four drinks for women), and whether participants exhibited behaviors making them at high risk for contracting HIV. Participant life history variation was assessed by the 20-item Arizona Life History Battery Short Form (Mini-K; Figueredo et al., 2006).

A hierarchical linear regression was performed for each health behavior indicator, entering demographic factors automatically in the first step. These included race/ethnicity (categorized as Non-Hispanic White and Non-White), participant sex, age in years, and years of education completed (see Table 1 for descriptive statistics). Life history (K) scores were entered if they explained substantial variance in the health behavior indicator once demographic factors were accounted for.

Table 1. *Variable Descriptives (N=2932)*

Variable	<i>M</i>	<i>SD</i>
Age in Years	55	16
Education in Years	13	2
Exercise in Minutes per Week	153	262
Fruit and Vegetable Servings per Day	4	3
Alcoholic Drinks per Month	8	25
Percentages		
Race/ethnicity		
Non-Hispanic White	71%	
Non-White	29%	
Female	73%	
At Least 5 Fruit and Vegetable Servings per Day	25%	
Tobacco Smoker	24%	
Binge Alcohol Drinker	15%	
At High Risk for HIV	6%	

Results

Life history (K) scores were substantial predictors of all health behavior indicators in the predicted direction (see Table 2). Slower life history was uniquely associated with performing more physical exercise, consuming more fruits and vegetables, reaching the recommended amount of five or more fruits and vegetables

servings per day, lower likelihood of being a tobacco smoker, having a lower overall consumption of alcohol, lower likelihood of being a binge alcohol drinker, and being less likely to exhibit behaviors consistent with high risk of contracting the HIV virus.

Table 2. *Beta Values for Predicting Health Related Behaviors*

Behavior	<i>n</i>	Non-White	Male	Age	Education	<i>LH (K)</i>
Exercise	2490	-.026	.114***	-.100***	.062**	.055**
Fruits & Vegetables/Day	2494	.071	-.068***	.039	.063**	.099***
5+ F&V/Day	2579	.054**	-.087***	.052**	.061**	.105***
Tobacco Smoker	2679	.070***	.004	-.215***	-.208***	-.069***
Alcohol Consumption	2487	-.046*	.180***	-.109***	.000	-.042*
Binge Drinker	2677	-.101	.090***	-.216***	-.030	-.062**
At High Risk for HIV	2576	.017	.105***	-.118***	-.009	-.108***

Note: * $p < .05$; ** $p < .01$; *** $p < .001$.

Demographic factors also explained unique variance in health behavior indicators. Older individuals performed less exercise, were more likely to the meet recommended level of fruit and vegetable consumption, were less likely to be a tobacco smoker and binge drinker, consumed less alcohol, and were less likely to be at high risk for HIV. Men performed more exercise, consumed fewer fruits and vegetables, were less likely to the meet recommended level of fruit and vegetable consumption, were more likely to be a tobacco smoker and binge drinker, consumed more alcohol, and were more likely to be at high risk for HIV. Those with higher levels of educational attainment performed more exercise, consumed more fruits and vegetables, were more likely to the meet recommended level of fruit and vegetable consumption, and were less likely to be a tobacco smoker. Non-Whites were more likely to the meet recommended level of fruit and vegetable consumption, were more likely to be a tobacco smoker, and consumed less alcohol.

Discussion

Human life history variation substantially predicts a broad range of health promoting and health adverse behaviors, independent of socio-demographic factors. The analyses provide a strong test of the hypothesized relationship between life history and health behavior indicators, as life history variation co-varies with these socio-demographic factors. Advances in technology will continue to increase survival rates; yet traditional public health efforts may be reaching their limits of effectiveness in encouraging health-promoting behaviors. Integrating an evolutionary framework, especially an understanding of life history theory, into

public health research and practice may revitalize behavioral health promotion efforts.

Many current health intervention efforts rest on the assumption that if people only had the relevant information and opportunity, they would always make healthy choices. This perspective may neglect the reality of human motivation and conflicts of interest. A life history framework provides a scientific basis for creating broader structural changes promoting healthy lifestyles. Environmental uncertainty, where personal safety, social support, and access to important resources are not reliable foster tendencies to discount future health in favor of immediate rewards. Longer-term, risk averse strategies would be more prevalent if perceptions that current effort will pay off in the future are enhanced by providing greater stability.

Evolutionary theory provides a powerful framework for understanding patterns in complex health phenomena. Our health status results from traits shaped by natural selection interacting with environmental and cultural variations, giving rise to complex patterns that would be difficult to explain with a non-evolutionary framework. The integration of evolutionary principles would enhance the effectiveness of health interventions and provide an ultimate explanation for patterns in health outcomes. There will likely be increasing interest in utilizing the evolutionary framework for understanding health-related issues. The pace at which health researchers adopt this framework will be shaped by the benefits which evolutionary theory brings to theoretical advancement, and perhaps more importantly, by increasing the effectiveness of health promotion efforts. If health research is to continue advancing as a science, this integration will be inevitable. An evolutionary perspective offers an integrative and comprehensive causal framework for understanding health phenomena that are of both great theoretical interest and practical importance.

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Evaluación psicométrica de la historia de vida predice la conducta de salud

Resumen

La teoría de historia de vida es un marco poderoso que puede ayudar en la promoción del entendimiento de la variación en los patrones conductuales de salud y por qué varían según las condiciones ambientales. La historia de vida de un organismo refleja los compromisos hechos en la distribución del esfuerzo hacia aspectos específicos de sobrevivencia y reproducción durante toda la vida. Este estudio examina la relación entre los indicadores psicológicos de la estrategia de la historia de vida y las conductas de salud en la muestra demográficamente representativa del Medio Oeste de EE.UU. Historias de vida más lentas predicen niveles más altos de conductas que promueven la salud y niveles más bajos de conductas que perjudican la salud, incluso cuando se controlan los factores sociodemográficos relevantes. El análisis proporciona una prueba fuerte de la relación hipotética entre la historia de vida e indicadores de conducta de salud, según como la variación de la historia de vida covaría con estos factores sociodemográficos. Los esfuerzos de la salud pública tradicional puede que lleguen a sus límites de efectividad en la estimulación de conductas que promueven la salud. Integrar un marco evolutivo podría revitalizar los esfuerzos de promoción de salud conductual.

Palabras claves: historia de vida, salud, conducta de salud, evolución

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