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Original Article

An Evolutionary Perspective on Health Psychology: New Approaches and Applications

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Abstract: Although health psychologists' efforts to understand and promote health are most effective when guided by theory, health psychology has not taken full advantage of theoretical insights provided by evolutionary psychology. Here, we argue that evolutionary perspectives can fruitfully inform strategies for addressing some of the challenges facing health psychologists. Evolutionary psychology's emphasis on modular, functionally specialized psychological systems can inform approaches to understanding the myriad behaviors grouped under the umbrella of "health," as can theoretical perspectives used by evolutionary anthropologists, biologists, and psychologists (e.g., Life History Theory). We detail some early investigations into evolutionary health psychology, and we provide suggestions for directions for future research.

Keywords: health psychology, life history theory, tradeoffs, pathogen avoidance

Introduction

The consequences of poor health are among the most significant challenges currently facing Western nations. In 2012, health care costs in the U.S. are estimated to be 2.8 trillion dollars. By 2020, they are estimated to surpass 4.6 trillion dollars (Center for Medicare and Medicaid Services, 2011). Investigations into the factors that are associated with health-enhancing or health-compromising behaviors thus have great practical utility. Indeed, a commentary recently published in *Nature* documented the results of a meeting organized by the U.S. National Science Foundation in which social scientists were asked to identify "grand challenge questions that are both foundational and transformative." The

number one priority on this list of grand challenges was "How to induce people to take care of their health" (Giles, 2011).

Health psychology has emerged as a field of inquiry aimed at understanding the psychological factors that shape health-relevant behaviors. Health psychologists often appeal to social cognitive models of behavior, and the constructs within them, to understand, predict, and change behavior. The success of these efforts can be viewed from a glass-half-full perspective. Meta-analytic reports demonstrate that many of these model development efforts result in small to moderate amounts of variance in behavior accounted for (McEachan et al., 2011) and some success at behavior change (Webb and Sheeran, 2006), and interventions that have a basis in these theories are typically more successful than those that do not (Painter et al., 2008). For example, theory-based interventions to decrease risky sexual behavior have been shown to increase condom use and decrease sexually transmitted infections in high risk populations (e.g., Bryan, Schmiege, and Broaddus, 2009; DiClemente et al., 2009), and interventions to increase physical activity have had some success, particularly for the initiation of physical activity among sedentary individuals (Marcus et al., 2007; King et al., 2007).

One could also view the success of these efforts from a glass-half-empty perspective. Current efforts to change health behavior are, in most domains, unsuccessful. An obesity epidemic continues in Western countries and is rapidly expanding across the globe (James, 2008). This, combined with sedentary lifestyle—another epidemic—contributes to extensive morbidity and mortality from cancer (Calle et al., 2003), heart disease (Manson et al., 1990), and type II diabetes (Dandona et al., 2004). HIV/AIDS continues to decimate young people's lives around the world, and more common sexually transmitted infections (e.g., *Chlamydia trachomatis, Neisseria gonnorrhoeae*) increase the risk of sterility and other negative health outcomes (Hillis et al., 1997). Despite public health efforts, approximately 25% of Americans still smoke cigarettes (Fiore et al., 2008), and only 5% of Americans achieve recommended levels of physical activity (Troiano et al., 2008). Even when interventions change behavior initially, behavioral change is difficult to maintain (King et al., 2009; Johnson et al., 2010). In sum, current approaches to understanding and improving health behavior have substantial room for improvement (McBride et al., 2012).

We propose that, just as evolutionary theory has significantly influenced the way that psychologists understand topics such as morality (DeScioli and Kurzban, in press), sexuality (Thornhill and Gangestad, 2008), and cooperation (Cosmides and Tooby, 1992), it can add critical insights into how we understand, predict, and change health behavior. In this paper, we first comment on the evolved psychology of health. We then provide examples of theoretical perspectives and research programs used by evolutionary psychologists that may help generate novel hypotheses for understanding health behavior and, ultimately, construct novel interventions.

Evolution and Health

Since 1948, the World Health Organization has defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or

infirmity." Major lines of inquiry within health psychology thus investigate a broad range of behaviors, including smoking, exercise, diet, cancer screening, and safer sex. In our review of theory and findings related to health, then, we address varied aspects of human evolved psychology that could influence each of these areas.

At first blush, it may seem reasonable to suggest that humans should have an evolved motivation to be healthy. After all, individuals in good health would be expected to survive longer and reproduce more than individuals in poor health. Such assumptions of domain general psychological mechanisms that function to avoid disease and death or pursue health implicitly or explicitly underlie existing theoretical perspectives within health psychology (e.g., terror management health model, health belief model; Goldenberg and Arndt, 2008; Rosenstock, 1974). However, natural selection is not expected to favor traits that maximize "survival" or "health." Indeed, under many conditions, selection may favor phenotypes that are uncorrelated with or even *negatively* correlated with longevity and health (Getty, 2002; Kokko et al., 2002). Life history theory has developed to describe and understand the manner in which organisms allocate finite energetic resources and time to fitness-relevant systems such as somatic development and maintenance, intrasexual competition, courtship, child-rearing, etc. (these are sometimes categorized into domains of "somatic" and "reproductive" efforts; see Charnov, 1993; Stearns, 1989). Selection should not favor the development of phenotypes that maximally invest in "health" processes, because the costs of these investments come at the expense of lifetime reproductive success.

Motivating Health is Not a Plausible Evolved Psychological Function

Instead of evolving to motivate general adaptive behavior such as "avoid death," "reproduce," or "be healthy," psychological adaptations are designed to take specific information from the environment, process that information, and output behaviors that were probabilistically adaptive in the environments in which they evolved (e.g., Tooby and Cosmides, 1992, 2005; Barrett and Kurzban, 2006). Selection is expected to favor modular, domain specific information processing systems over abstract, domain general systems for several reasons. We mention two. First, just as organs that are specialized to perform distinct tasks (e.g., circulate blood, filter wastes, produce gametes) have evolved instead of a "master organ" that generally functions to "survive," psychological systems that are functionally specialized have a selective advantage over domain general systems. The systems that detect kinship and motivate incest avoidance, for example, use a different set of cues and lead to different behavioral outputs than the systems that detect infectious microbes and motivate pathogen avoidance (Lieberman et al., 2007; Tybur, Lieberman, Kurzban, and DeScioli, in press). It is implausible that a master drive to pursue "health" governs all (or, indeed, any) of the myriad health relevant behaviors in the modern environment. Instead, the psychological mechanisms that influence some health-relevant behaviors (e.g., drinking alcohol) likely operate distinctly from the systems influencing other health-relevant behaviors (e.g., getting regular cervical exams).

Second, to fulfill domain general functions such as "avoid death" or "promote health," psychological mechanisms would require what has been referred to as "fitness teleology" (Tooby and Cosmides, 1992, 2005; Symons, 1989). That is, organisms would

need to know the long-term health outcomes of specific behaviors, and they would need to act in the specific manners that optimize such outcomes. This is certainly not the case with other fitness relevant behaviors. For example, no psychological mechanism functions to motivate "reproduction"—otherwise, men would be strongly motivated to donate sperm, women would be motivated to donate eggs, and both sexes would be stridently opposed to any form of contraception. Instead, in the mating domain, functionally specific mechanisms assess qualities that have reliably correlated with mate value in conspecifics and output attraction to those conspecifics (e.g., if I am a man, be attracted to females with cues to fertility and genetic quality and compatibility; if I am a woman, be attracted to men with cues to genetic quality and compatibility and intrasexual competitive ability), which in turn enacts the series of behaviors that probabilistically led to conception in the environment in which the psychological adaptations evolved.

The existence of (preventable) health epidemics related to obesity, sexually transmitted infections, and lifestyle oriented cancers is difficult to reconcile with a perspective positing the existence of a quasi-teleological motivation to engage in "healthy" behaviors. Instead, it suggests that we have an evolved psychology that, while *influencing* health in the 21st century, does not primarily function to motivate good or bad health. Rather than flipping a master "health" switch, different types of health behaviors likely respond to different inputs, and, critically, different types of interventions. Applying this perspective may meaningfully advance how we understand health behavior and how we might encourage change. We now explore a few examples of theoretical perspectives and hypothesized psychological systems that may be useful in understanding health-relevant behavior.

Life History Theory and Health

As stated previously, life history theory aims to understand the manner in which organisms allocate finite energy budgets toward different fitness-relevant systems. Based on environmental and phenotypic conditions, individuals may follow different life history strategies—that is, different strategic resource allocations. This perspective may be useful for understanding, predicting, and changing a number of health behaviors. Here we address physical activity (exercise), a health behavior that directly addresses strategic uses of energy.

In modern Western societies, which are largely sedentary, physical activity is associated with a variety of positive health outcomes (Warburton, Nicol, and Bredin, 2006). In the calorie-limited environments in which the psychological systems influencing exercise evolved, however, rigorous or sustained physical activity entailed substantial direct energetic costs, as well as costs related to the development and maintenance of metabolically expensive muscle tissue. Some exertion provided offsetting benefits, such as running down prey, migrating and foraging over long distances, and protecting self and kin from predators and violent conspecifics. Hence, the psychology of physical activity should lead humans to be *selectively* active, with activity varying as a function of ecological and phenotypic conditions.

One of the major costs of exertion is increased vulnerability to long-term calorie

deficit. When individuals develop in environments indicative of relatively high risk of calorie deficit, they may conserve energy by reducing activity. Human and non-human animal literature is consistent with this perspective. For example, in a meta-analysis of 13 Scandanavian birth cohorts, lower than normal birth weight—potentially a cue to caloric stress in adulthood—was related to lower leisure time physical activity later in life (Andersen, 2009). In another study, low birth weight was not associated with cardiorespiratory fitness, but was related to a higher energy cost of running (Baraldi et al., 1991). In rats, mothers' undernourishment—potentially a cue to resource availability in the environment—predicts offspring physical activity regardless of post-natal food availability, with offspring of malnourished mothers being less active (Vickers et al., 2003). Taken together, this suggests that life history strategies calibrated during early development may influence physical activity in adulthood. This framework could be used to predict who will be at risk for low activity later in life. Moreover, future work in this area could develop different interventions for increasing exercise depending on calibrated life history strategy.

This framework can also elucidate sex differences in the psychology of exercise. Given the higher metabolic demands associated with pregnancy and lactation (up to 700 more kcals/day) physical activity in women is associated with higher trade-offs with reproductive effort. Indeed, research has shown that women's fecundity decreases with increased energy expenditure (Ellison, 2003), and that the postnatal period of lactational amenorrhea is sensitive to energy expenditure (Ellison, 2008). Men's reproductive physiology, on the other hand, is generally less energetically costly and more robust in the face of reductions in energy availability or increases in energy expenditure. The quantity and quality of sperm production, for example, appears to be insensitive to short term changes in energy availability (Bribiescas, 2006). Epidemiological data on current exercise behavior are consistent with a higher cost for women of being physically active, as women reliably report lower levels of physical activity than men (Buckworth and Dishman, 2007). Interventions targeting increased exercise may thus be maximally effective if they tailor interventions to evolved, sex-specific psychologies.

Life history theory may also inform individual differences in a variety of other health-relevant behaviors. Human life history strategies vary along a continuum. Some individuals allocate effort in a "slower" manner, with a focus on investment in embodied capital, maintenance, and delayed reproduction, and some individuals allocating effort in a "faster" manner, with greater allocations toward earlier reproduction and mating effort (Ellis et al., 2009). Early life experiences hypothesized to shape life history strategies (e.g., environmental instability) relate to a number of indices of risk in early adulthood, including age of sexual debut, number of sexual partners, and criminal activity (Belsky, Schlomer, and Ellis, 2012; Simpson et al., 2012). Other early life experiences (e.g., family socioeconomic status) appear to shape the manner in which people respond to ecological threats later in life, with individuals from lower socioeconomic backgrounds responding to cues to mortality threat by taking more financial risks, discounting the future, and reporting wanting children earlier (Griskevicius et al., 2011a,b). If certain health behaviors reflect greater investment in slow versus fast life history strategies, interventions could target individuals likely to engage in such behaviors based on relevant risk factors (e.g., stability of childhood environment), and could tailor intervention content to slow versus fast

strategists (Ellis et al., 2012). Further, such an appreciation for the role of early developmental context could provide a more coherent understanding of the co-morbidity of a number of health risk behaviors (e.g., early sexual debut, substance abuse, impulsive behavior) than perspectives that assume such behaviors are associated simply because adolescents seek to be "deviant" or are the result of association with deviant peers (c.f. Jessor et al., 1995).

Psychological Systems for Courtship and Competition

Under a life history theory framework, investment in mating often comes at the expense of investment in maintenance, survival, and, ultimately, health. Such tradeoffs between fertility and mortality can reflect behavioral tradeoffs—tactics used to improve intrasexual competitive ability. A collection of research demonstrates shifts toward costly mating tactics during periods of life in which intrasexual competition is high (e.g., Wilson and Daly, 1985) or after experimental primes indicative of mating opportunities (e.g., Griskevicius et al., 2009). These costs may extend to behaviors that enhance courtship or intrasexual competitive ability at the expense of health. Hill and Durante (2008) describe evidence supporting this perspective. Women who were primed with intrasexual competition reported a greater willingness to tan and take diet pills, both of which presumably increase women's intrasexual competitive ability at the expense of health. However, this shift in health risk intentions did not extend to other health risks presumably unrelated to courtship and competition (taking cough syrup as a sleeping aid and painting in an unventilated room).

Psychological mechanisms underpinning intrasexual competition have also been proposed as influencing eating disorders (see Ferguson et al., 2011). This hypothesis generally takes two forms. One suggests that women may strategically suppress their own fertility when intrasexual competition is intense by under eating, because such competition may be associated with lowered offspring viability. The other suggests that restricted eating in Western societies may be a strategy for increasing physical attractiveness and outcompeting others for mates. Both hypotheses have received some empirical support (e.g., Li et al., 2010; Salmon et al., 2008)

The psychological systems underpinning courtship and intrasexual competition may also *increase* some healthy behaviors. In U.S. samples, men and women exercise in ways that target physical attractiveness in a sex-specific manner (Jonason, 2007; Mealy, 1997). Interventions could capitalize on the connection between exercise and mating psychology, particularly during periods of life associated with intense competition for mates. Further, if courtship and intrasexual competition psychology influences both unhealthy (e.g., tanning) and healthy (e.g., exercising) behaviors, future research could investigate methods for encouraging one strategy over the other.

Psychological Systems for Neutralizing Pathogens

Recent studies concerning the "behavioral immune system"—psychological adaptations that function to neutralize pathogens—have addressed topics ranging from

personality to xenophobia and social cognition (see Schaller and Park, 2011, for a review). Given that many of the issues tackled by health psychologists concern infectious diseases (e.g., HIV) or behaviors that are regulated by pathogen-avoidance mechanisms (e.g., eating), an application of this literature and theory may prove useful to health psychology. We consider two such behaviors below: eating and sexual decision making.

The mouth is a vulnerable point through which pathogens can enter the body and wreak havoc. Each act of eating puts an individual at risk for ingesting pathogens housed within food (e.g., roundworms in pork) or on food (e.g., food that has been coughed on by a contagious conspecific). Hence, some of the psychological mechanisms influencing dietary decisions likely function to neutralize pathogens (Fessler and Navarrete, 2003; Flaxman and Sherman, 2000; Rozin and Fallon, 1987). Tybur et al. (in press) suggest that pathogen-avoidance behaviors are triggered when systems weighing several factors (e.g., likelihood of pathogen presence; expected costs of infection; expected benefits of engaging in the potentially infectious behavior) estimate the net expected value of contact with an object as especially low. Dietary interventions could target some of these putative inputs, such as likelihood of pathogen presence. For example, interventions designed to reduce consumption of meats processed by industrial farming could create a link between the food product and a pathogen cue, such as fecal contamination (e.g., Pollan, 2006).

Like eating, sexual intercourse allows microorganisms a route through which to enter and colonize the body. Some microorganisms—sexually transmitted infections (STI's)—have evolved to take advantage of this route of transmission. Given sufficient education on the risks of STI's, an optimal strategy for those who wish to minimize STI risk would be to simply abstain from intercourse. The enduring prevalence of sexual interactions in the face of such information suggests that the psychological systems that motivate sexual behavior are not governed by such rational infection concerns. Barrier methods (e.g., condoms) have been developed to mitigate the most infectious aspects of penile-vaginal intercourse (i.e., exchange of sexual fluids) while accommodating the evolved psychological systems that motivate sex. Nevertheless, people use condoms at a suboptimal level for avoiding STI's, and increasing condom use is a major goal within health psychology.

Condoms are *not* used for a variety of reasons, including the social stigma associated with purchasing, carrying, and using condoms, and the smell and sensation of sex with condoms (Bryan, Schindeldecker, and Aiken, 2001). They *are* used to some extent because people are able to associate their use with decreased risk of STI transmission and, perhaps even more, appreciate their pregnancy prevention effectiveness (Cooper, Agocha, and Powers, 1999). To increase condom use, then, interventions must either attenuate the costs associated with condoms (e.g., increasing sensation), or increase the net benefits of using condoms. Such benefits could conceivably be increased by increasing perceptions of vulnerability to HIV and other STI's. However, rational perceptions of vulnerability to STI's relate weakly and inconsistently to condom intentions (Gerrard, Gibbons, and Bushman, 1996), and having previously had an STI and receiving STI education are negatively related and unrelated to condom intentions, respectively (Sheeran and Taylor, 1999). Moreover, decades of research have demonstrated that increasing fear of STIs is not an effective intervention strategy for motivating safer sexual behavior (Albarracín et al.,

2005). Tybur et al. (2011) recently suggested that, although attempts to manipulate objective fear of STI's may not influence condom use, the psychological systems functioning to neutralize pathogens—and, critically, the ecological cues indicating pathogen presence—might. They found that participants exposed to olfactory cues to pathogens (notably, pathogens that are not specific to STI's) reported greater intentions to use condoms over the next six months than participants in a control condition. These findings suggest that psychological systems that evolved to detect pathogens—part of a "behavioral immune system"—may play an important role in decisions relevant to sexual health. Future interventions designed to increase condom use—or to encourage other sexual health behaviors that may be influenced by pathogen-avoidance psychology—may capitalize on this connection.

Future Investigations into Evolutionary Health Psychology

A marriage between evolutionary psychology and health psychology can yield substantial benefits to both areas. Evolutionary psychologists interested in topics such as courtship, intrasexual competition, energy allocation, and pathogen-avoidance may gain critical insights into the psychology of these domains by incorporating health-relevant measures into their investigations. Health psychologists interested in maximizing the explanatory power of theories and the utility of interventions over disparate arrays of health problems may find the modular perspective used by evolutionary psychologists helpful.

We generally suggest that these efforts can take two forms. First, although it is increasingly recognized that the "one-size-fits-all" interventions commonly utilized in health psychology are suboptimal (Seefeldt, Malina, and Clark, 2002), health psychologists have not been terribly successful in uncovering the critical factors that will define which interventions have maximal utility for which groups (Cahill, Lancaster, and Green, 2010). An evolutionary perspective can be used to categorize individuals into such groups, and to inform what types of interventions would be effective for these groups. Second, evolutionary perspectives can identify which specific inputs (e.g., cues to intrasexual competition; cues to pathogens) may affect which health behaviors. These inputs are critically important in the development of intervention content.

In this paper, we have offered a few suggestions of how lines of research pursued by evolutionary psychologists have informed health behavior and can inform health behavior further. This is only the tip of the iceberg. Though we have not reviewed in any detail behaviors such as smoking, dental care, cancer screening, binge drinking, substance abuse, and adherence to medications, all of these are strongly related to health outcomes and could be informed by an evolutionary perspective. Our attempts at increasing health behavior and decreasing risk behavior may have reached something of a glass ceiling of effectiveness. It is now time to apply innovative methods and novel perspectives if we hope to shatter that glass ceiling and have meaningful and sustained impact on morbidity and mortality. An evolutionary psychological perspective, with its carefully articulated theories of evolved psychological structure and function, is likely to be a highly fruitful avenue to pursue as we seek to promote optimal physical, mental and social well-being, and not simply the absence of disease.

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