University of Alberta

Linking Fitness and Holistic Medicine:
Using Growth Models to Correlate Adult Canadians' Individual Physical Activity and Use of Holistic Medicine

by

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Diversity, complexity, and ambiguity of human judgment are enemies of technique. They mock statistics and polls and standardized tests and bureaucracies.

– Neil Postman

ABSTRACT

The use of holistic medicine (HM) is increasing dramatically in Canada (Statistics Canada, 2005; Tzu Chi Institute, 2004; de Bruyn, 2001). While some researchers attribute this growth primarily to a disenchantment with biomedicine that pushes users to try HM, others propose that compelling aspects of HM are pulling users who engage in a variety of health-aware behaviours. In particular, fitness culture and HM are thought to share core elements such that people who embrace the ideals of fitness more readily rationalize using HM (Goldstein, 2000). This study tests this theory using four waves of longitudinal data collected on a nationally representative sample of Canadian adults (N=9343) participating in the National Population Health Survey. Results from growth curve analysis indicate that leisure-time physical activity is positively associated with both initial and changing HM use. In an era of health promotion initiatives that encourage physical activity, these findings suggest that the relationship between fitness and HM could impact the individualization of health care and the integration of HM and biomedicine.

To Mom and Dad, for your unfailing love and support.

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LIST OF ABBREVIATIONS

BMI	Body-Mass Index
CAM	Complementary and Alternative Medicine
CM	Complementary Medicine
CMA	Census Metropolitan Area
COM	Conventional and Orthodox Medicine
GLIMMIX	SAS Macro for Fitting Generalized Linear Mixed Models
HM	Holistic Medicine
HUI	Health Utility Index
LTPA	Leisure-Time Physical Activity
MET	Metabolic Expenditure Unit
NPHS	National Population Health Survey
RDC	Research Data Centre
REPL	Restricted Pseudo-Likelihood Estimation
SSHRC	Social Science and Humanities Research Council of Canada

CHAPTER 1: Introduction and Literature Review

Canadians enjoy an exceptionally high level of health. The majority of Canadians report that their health is excellent or very good and life expectancy in Canada is among the highest internationally (Canadian Population Health Initiative, 2004) Like most other industrialized nations, Canada devotes a great deal of its wealth to keeping its citizens healthy, primarily through its publicly funded health care system. While this presumably reflects "a belief that the receipt of appropriate health care is the most important determinant of health" (Evans, 1994: 4), the link between health and health care spending has been shown to be tenuous (Williams et. al., 2001; Freund & McGuire, 1999; Ramsay, Walker & Alexander, 1999; Marmor, Barer & Evans, 1994). Canada's health care system is not in a state of crisis,[1] yet public confidence has been eroded by unresponsiveness to the relentless pressure to expand health services in directions that would truly address the health needs of Canadians (Evans & Stoddart, 1994; Marmor et. al., 1994). Canadians seem to understand inherently what the research suggests, that a "society that spends so much on health care that it cannot or will not spend adequately on other health-enhancing activities may actually be reducing the health of its population" (Evans & Stoddard, 1994: 55). Health, defined by the World Health Organization (in Evans, 1994) as "a state of complete wellbeing" (24), is not experienced in simplistic or reductionistic ways, but rather is a product of a multitude of uncertainties. Health results from social, economic and cultural determinants, including education, employment, income, housing, environmental factors, genetics, gender, early childhood development, and community and social supports, among others (Canadian Population Health Initiative, 2004; Keleher & Murphy, 2004; MacDonald, 2003; Eckersley, Dixon & Douglas, 2001; Evans, Barer & Marmor, 1994).

Although the Canadian health research and policy agendas remain primarily based on a mechanistic and individualistic medical model that fails to adequately address the diversity of social and environmental health determinants (Armstrong & Armstrong, 2003; Corin, 1994; Evans & Stoddard, 1994), wide recognition of these determinants has drawn some attention to innovative health strategies. Calls to invest more resources in health promotion and to explore novel roles for holistic medicine (HM) are among these strategies.

1.1. Defining Holistic Medicine

Holistic medicine is not clearly defined. A significant problem encountered by HM researchers and policymakers is the lack of agreement over which modalities to include under the general rubric of HM; a glance at inconsistent and non-standardized HM survey instruments illustrates this dilemma. The commonly accepted definition of complementary and alternative medicine (CAM), a term used synonymously with HM, emerged from a working group of the United States Office of Alternative Medicine. It states that:

> Complementary and alternative medicine is a broad domain of healing resources that encompasses all health systems, modalities, and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health system of a particular society or culture in a given historical period. CAM includes all such practices and ideas self-defined by their users as preventing or treating illness or promoting health and well-being. Boundaries within CAM and between the CAM domain and the domain of the dominant system are not always sharp or fixed (in Achilles, 2001: 2).

Applying this definition in a contemporary North American context establishes HM as a catch-all category for the immense variety of therapies that "are not readily integrated into the dominant health care model, because they pose challenges to diverse societal beliefs and practices" (Eskinazi, 1998: 1622). This catch-all category is necessarily transitory, as the definition only links therapies by counterposing their ideologies to a narrow definition of scientific rationality. It neither recognizes how some HM modalities are strongly tied to the dominant biomedical system while others diverge radically, nor how physicians tend to apply the label of "alternative" only to those modalities in which they are least trained (Frohock, 2002). HM and biomedicine have long been analogized to two competing Greek deities and their approaches to achieving health (Renaud, 1994; Dubos, 1959). HM systems are compared with Hygeia, who symbolizes health achieved through discovering and living in harmony with the laws of nature and the environment, and biomedical systems are compared to Asclepius, who represents health achieved through human interventions that limit illness and disability. Although the final sentence of the definition acknowledges that HM and biomedicine are far more intricately interwoven than this analogy suggests, the definition is not particularly helpful in determining which modalities should be included in HM.

With no sharp, distinctive category of HM, researchers trying to analyze its constituents have classified HM modalities in a variety of ways. For example, O'Connor (in Frohock, 2002) identifies seven categories of HM modalities: 1) alternative systems, like acupuncture, Ayurveda, and homeopathy; 2) bioelectromagnetics; 3) lifestyle alterations; 4) herbal or botanical medicine; 5) manipulative and body-based systems, like massage, osteopathy, and therapeutic touch; 6) mind-body control, like biofeedback, hypnotherapy, and meditation; and 7) pharmacobiological treatments, like the use of antioxidants. Achilles et. al. (1999) integrate a number of studies to create an almost identical classification framework, as does the National Center for Complementary and Alternative Medicine in the United States (in Achilles, 2001). Jonas' (2002) framework, in contrast, categorizes treatments by the degree to which they are generally accepted and used as adjunct therapies by biomedical practitioners. Vitamin use and dietary therapies are examples of integrated treatments that are embraced by the biomedical community. Emerging or mid-range treatments include acupuncture and herbalism, and frontier treatments, those furthest from the dominant system, include prayer and therapeutic touch. In a similar classification continuum, Barfod (in Brody, 2002) labels therapies that are distant from biomedicine "fragile" (78). Conflict about classification exists even when using such detailed frameworks. Folk medicine, for instance, does not fit anywhere in O'Connor's categorization, even though Hufford (2002) argues that it is rightfully a form of HM rather than a term to be used synonymously with HM.[2] Folk medicine does fit within Kelner and Wellman's (2000) framework, which classifies HM modalities by the context in which they are delivered. Folk medicine and faith healing are examples of social/community forms, while clinical forms include chiropractics and homeopathy, and psychological/behavioral forms include yoga and biofeedback. This framework ignores other modalities, however, particularly those like vitamin use that are used privately in the home.

Most HM surveys do not employ such systematic classification schemes, but instead define HM ad hoc through the lists of modalities that respondents are questioned about. For example, respondents were asked in Ramsay et. al.'s (1999) survey if they used acupuncture, chiropractics, homeopathy, herbal therapies, megavitamins, spiritual healing by self, spiritual healing by others, diet programs, lifestyle diet, relaxation techniques, imagery techniques, massage therapy, energy healing, folk remedies, self-help groups, biofeedback, hypnosis, naturopathy, yoga, osteopathy, chelation, aromatheraphy, herbs and vitamins, special diet programs, and books or classes. Many surveys ask about far fewer forms of HM, yet even this long list ignores some modalities which otherwise fall under the rubric of HM, for example magnetotheraphy and reflexology.

Surveys and research in general use a variety of terms synonymously with "holistic medicine". This list includes, among others, "complementary medicine (CM)", "alternative medicine", "complementary and alternative medicine", "unorthodox medicine", "non-mainstream medicine", "unconventional medicine", "unproven medicine" and all of the above using "health care" in place of "medicine".[3] All tend to broadly encompass the same group of treatments, and the selection of a label depends primarily on the social context and political agenda of the researcher. As Frohock (2002) notes,

> All versions of unconventional medicine depend on the existence of conventional medicine... distinctions between alternative and conventional medicine are variables of time and place (215-6).

In a contemporary North American context, working with residual labels of HM (as what is *not* biomedical) reinforces a structurally marginalized role for HM. "Holistic medicine" is a positive label that emphasizes the nature of the modalities that can be grouped together. Positive labels do not inadvertently privilege those ethnocultural groups that conventionally use biomedicine. No assumptions are made about HM use or even about whether it would actually be possible for an HM user in Western culture to entirely avoid using biomedicine (Han, 2002).

The term "medicine" is used rather than "health care" in this study in order to emphasize the focus across HM modalities on fostering wellness. The term "biomedicine" is used in reference to the positivistic and materialistic medical system that dominates in Western countries. This dominant medical system is referred to elsewhere as "conventional and orthodox medicine" (COM), a historically inaccurate label, or as "allopathic medicine", a term traditionally used to distinguish "regular" medicine from homeopathy. Bates (2002) has even proposed, somewhat tongue-in-cheek, that HM shares far more commonalities than biomedicine with medicine's classical roots, and so it is the biomedical system that should rightly be termed "alternative"!

The commonalities of HM modalities that distinguish them from biomedicine have been studied in attempts to avoid the limitations of ad hoc definitions and residual labels. HM users interviewed by Low (2004) agreed that, although HM is difficult to define, there is "something" distinctive about the modalities that allows people to reframe their health problems from a novel perspective (14). It is this "something" that researchers attempt to isolate, and most ultimately identify the same core elements. It is important to note, of course, that these central characteristics refer to the model of practice and "how these models actually translate into real life practices is largely unexplored" (Achilles et. al., 1999: 16).

Holism is the core element most often associated with HM (Coulter, 2004; Low, 2004; Gibson, 2003; O'Connor, 2000; Achilles et. al., 1999; Goldstein, 1999; Eskinazi, 1998). Holism is more than an ontological fusing of mind, body and spirit; it encompasses "not only the physical, mental and social aspects of health but also the human being's past and future, their energy, goal seeking behaviour, the realization of self over time, and even spiritual dimensions" (Patel, 1987: 169). Another central value of HM is vitalism, or the belief in a life force or healing energy that naturally propels humans towards health (Coulter, 2004; Low, 2004; O'Connor, 2000; Goldstein, 1999).[4] Valuing vitalism leads to a focus on self-healing in HM modalities – to be healthy is effectively to engage with the healing process and therefore with the goal of achieving a state of harmony or balance of the whole self in its environment (Frohock, 1999; Eskinazi, 1998). The responsibility for health is discursively shifted from the practitioner to the HM user, as both are engaged in fostering the user's vitalism. This view of health as an individualized state of wellness is a third core element of HM (Coulter, 2004; Hughes, 2004; Low, 2004; Achilles et. al., 1999; Goldstein, 1999). Health is perceived as a positive state on a continuum with illness such that one can strive for increased wellness at any point. Treatment is about maximizing health potential and patients are accorded expert status about their own subjective health process. Although holism, vitalism and an emphasis on wellness are the most commonly agreed upon core elements of HM, a variety of others have been proposed. Gibson (2003), for example, identifies empowerment as a central tenet of HM, yet Coulter (2004) points to humanism and therapeutic conservatism. Achilles et. al. (1999) emphasize a focus on patient responsibility, while Low (2004) examines the client/practitioner relationship in HM and proposes that it is fundamental to HM that, unlike doctors, practitioners aren't condescending or concerned with professional power, but instead are respectful and caring and spend more time listening to clients.

Determining these core elements provides a framework for more clearly defining HM, yet the focus remains on how the philosophical worldview of HM differs from biomedicine. HM and biomedicine are falsely polarized, much like in the labeling of this group of modalities. The abovementioned values imply that biomedicine always has a reductionistic, scientific focus on only the physical pathways to health, and that biomedicine always defines health negatively as an absence of pathology. The self is characterized as being absent in the biomedical encounter and discourses of empowerment, autonomy and control are portrayed as being particular to HM (Hughes, 2004: 28). Characterizations of HM as "chronic, holistic, individualistic, preventative, natural, slow and gentle, and non-invasive" effectively imply that biomedicine is "acute, dualistic, generic, curative, chemical, fast and brutal, and invasive" (Low, 2004: 55). While these iconic[5] characterizations are perhaps not altogether unfair,[6] they fail to recognize that the boundaries between these two categories are blurring as biomedicine undergoes a transition towards a more patient-centered, biopsychosocial, preventive approach. Although "many practitioners of conventional medicine have the view that alternative medicine is composed mainly of quacks" (Furnham & Forey, 1994: 459), it is now recognized that today's standard biomedical narratives originated in natural cures and in religious or spiritual discourses (Frohock, 2002). Some biomedical practitioners are now even offering certain HM services (Goldner, 2004), albeit that these doctors tend to employ rhetorical devices to distance themselves from HM practitioners who are not trained in biomedicine (Adams, 2004). False polarities between HM and biomedicine also render HM iconic. Although all modalities generally share the ideological tenets identified above, it is rarely recognized that these core elements are interpreted and expressed differently across modalities and even across individual practices within modalities (Willis & White, 2004; Peters, 1998).[7] HM must be located in its larger historical framework in order to understand how the consolidation of biomedical dominance beginning in the 19th century positioned biomedicine *against* HM, which continues to inform today's iconic and dualistic definitions and labels.

As Good (1994) points out, the history of medicine is not a "straightforward recording of the continuous discovery of the facts of nature" (22), and the institutionalized dominance of biomedicine was certainly not achieved because of a strong scientific evidence base. Indeed, early biomedical physicians in the 19th century were only a small minority of all those practicing the healing arts[8] – included were bone setters, midwives, nurses, barbers, folk healers and herbalists, among others – and most people opted not to consult these physicians because of the high risks of their "heroic" interventions. Professional dominance was achieved in just a few decades, rather, through a sociopolitical movement to achieve a state-legitimized monopoly over medical services (Armstrong & Armstrong, 2003; Freund & McGuire, 1999). In the late 18th century, physicians began calling themselves "regular" healers and entreated governments to give them exclusive rights to heal and to control who practiced under their auspices. These demands were not met because of any evidence of superior therapeutic outcomes, but rather because of their class, race and sex (Armstrong & Armstrong, 2003). The incorporation of Colleges of Physicians and Surgeons by the mid-19th Century formalized professional cohesion. The power of these colleges to establish medical schools, to grant medical degrees and licenses, and to implement codes of ethics that inevitably defined only their practices drove out "irregular" practitioners (Frohock, 2002; Freund & McGuire, 1999). Although non-physicians contested physicians' bid for dominance, the emergence of germ theory bolstered the power of physicians by decreasing the riskiness of their interventions and legitimizing their biochemical narratives. Developments in science allowed these biomedical practitioners to frame illness in terms of biological antecedents, an appealing framework and one incommensurable with the esoteric philosophies of other healing modalities at the time. Scientific legitimacy turned physicians into "experts," which resulted in social distance between patients and physicians; ironically, this distance only empowered physicians more (Freund & McGuire, 1999: 218). The dominance of biomedicine was secured through the publication of Flexner's 1910 report, *Medical Education in the United States and Canada*, which resulted in increased authority for physicians to control the scope of practice of all healers, as well as in the closure of many medical schools, particularly those teaching Blacks and women.

In the wake of this sociopolitical struggle for professional dominance, biomedicine "enjoyed a golden age of increasing influence, status and wealth" (Turner, 2004: xiv), while other modalities were forced to become a hidden health care system. By the early 1970s in Canada, all provinces "had established publicly funded medical insurance, guaranteeing payment for a whole range of procedures based on what individuals doctors considered necessary, and thus further reinforcing the dominance of both the doctors and their assumptions about care" (Armstrong & Armstrong, 2003: 25). Holistic modalities were haphazardly agglomerated during this period and forced to position themselves against biomedicine as a means of avoiding cooptation. This has changed over the last twenty-five years, however, as the dominance of biomedicine has been

> undermined, but obviously not eroded, by a complex set of global processes: new technologies, changes in consumer demand, the globalization of medical systems, the differentiation and fragmentation of scientific knowledge, the transformation of the pattern of disease and a variety of new social movements. (Turner, 2004: xix).

Power in the health field has been and is being reconfigured, allowing space for the slow but steady reemergence of HM and thus resulting in blurred boundaries between medical systems. Tataryn and Verhoef's (2001) framework recognizes these unclear boundaries and so classifies modalities from both systems according to their basic assumptions about the nature of health. Bates (2002) points out that this reconfiguration is not a sign of a bleak future:

> Indeed, in most societies and throughout history, the usual pattern has been one of medical pluralism, in practices – some more, others less compatible – have coexisted. Therefore, the previously mentioned hegemony of scientific medicine through the first three-quarters of the 20th century, especially in North America, has been somewhat atypical. ... So if, in the years to come, alternative medicine becomes more common and more accepted once again, that should be seen more as a return to the way things have historically been, rather than as some disturbing fragmentation of, or departure from the scientific ideal. (25).

1.2. The Increasing Use of Holistic Medicine in Canada

Holistic medicine is now widely available in Canada, as elsewhere in the industrialized world, and a substantial body of both qualitative and quantitative evidence (e.g. Statistics Canada, 2005; Goldstein, 2002; de Bruyn, 2001; Blais, 2000; Achilles et. al., 1999) demonstrates that Canadians are increasingly choosing HM as a means of curing illness and caring for health. A 2003 survey indicated that one fifth of Canadians consulted an HM practitioner in the year prior to the survey (Statistics Canada, 2005). In 1999, over a quarter of Canadians reported that they were current HM users, and nearly three quarters reported having used HM at some point in their lives (Ramsay, et. al., 1999). More than 70% of respondents in the same survey agreed that "conventional medicine does not have 'all of the answers' to health problems" and that "since alternative medicine has been used for centuries in other countries, there 'must be something good about it'" (Ramsay et. al., 1999: 24). Other public opinion surveys present similar statistics (e.g. Tzu Chi Institute, 2004; de Bruyn, 2001).

The amount of money being spent on HM also evidences its popularity. Canadians spent an estimated $3.8 billion on HM in the latter half of 1996 and the first half of 1997, which represents a per capita expenditure of $127.92 (Ramsay et. al., 1999). This choice to pay out of pocket for HM is particularly noteworthy in Canada, where public health care provides for biomedical care, but only minimally covers select forms of HM. Other indicators of the increasing demand for HM include the growing population of known Canadian HM providers[9] and the rising number of medical schools offering courses in HM (Ramsay et. al., 1999). Sixty-five percent of Canadian physicians perceive a demand for HM from their patients (Verhoef & Sutherland in Sirois & Gick, 2002) and a growing number of physicians refer their patients to HM practitioners (Crellin, Andersen & Connor, 1997). There is no indication that this trend in HM growth will end anytime soon. Indeed, the Canadian popular interest in HM has increased so dramatically in the recent years since its resurgence that it has been labeled both an "identity movement" (Goldstein, 1999: 232) and a "social movement" (Crellin et. al., 1997: 11).

In studying patterns of increasing HM use in Canada, Achilles et. al. (1999) did not anticipate national and provincial health organizations' significant lack of awareness about the status of HM in their various jurisdictions, nor did they expect the dearth of federal and provincial policies in this area. Although the growing popularity of HM has considerable potential to influence Canadians' use of Medicare services, Crellin et. al. (1997) note that governments at all levels have failed to conceptualize how HM contributes to the health of Canadians. Fundamental gaps in research about the role of HM within the larger health services context must be addressed before governments will broaden their perspectives. Is access to HM a determinant of health? Is HM an integral part of the health-seeking strategies of Canadians? This study contributes to addressing these gaps.

1.3. The Choice to Use Holistic Medicine

The use of medical systems is not a zero-sum game. A multitude of factors influence health service choices, whether biomedical or holistic or both, and implicit in these decisions are people's ad hoc hypotheses about health determinants. These determinants must be explored in attempting to understand why people use HM, as health-seeking behaviour depends not only on personal characteristics, values and health status, but also on cultural and environmental factors and on the expectations of what each system will provide (de Bruyn, 2001; Henderson & Ainsworth, 2001). Gilmore (2004) identifies five factors that affect a population's health choices: 1) socioeconomic characteristics; 2) sociodemographic characteristics; 3) lifestyle and health conditions; 4) psychosocial factors; and 5) health system characteristics. Although it fails to address the social determinants of medical use, the socio-behavioral model proposed by Andersen and Newman in 1973 (in Sirois & Gick, 2002; in Kelner & Wellman, 1997) includes similar individual factors. This model suggests that, while the most immediate cause of medical use is medical need, use is also indirectly determined by a person's "1) predisposition to use health services (e.g., beliefs, demographic, and social variables); [and] 2) ability to secure health services (e.g., income)" (Sirois & Gick, 2002: 1026). The Health Action Model, also devised in the early 1970s, "identifies key psychological, social and environmental influences on individuals adopting and sustaining health- or illness-related actions" (Tones & Green, 2004: 78). This fuller model is concerned with beliefs, motivations, normative influences and the self, and how all of these interacting systems enable and constrain both health intentions and behaviours. Pescosolido's (2000) Network Episode Model of health behaviour examines the pathways people take in responding to illness. This model suggests that "access to diverse medical systems cannot be studied apart from one another" and looks to social networks as underlying mechanisms that determine people's pathways (176). Although it is less apparent in some of these models, all presuppose that a health system or modality that is not publicly and structurally sanctioned will be a valid health choice for far less people; this explains the low levels of HM use during the golden age of biomedical dominance.

1.4. The Correlates of Holistic Medicine Use

There is currently great interest in understanding the health-seeking behaviours that lead people to use HM, and researchers have long been studying the correlates of HM use as part of this larger interest. Strong, if not entirely consistent, consensus exists about the socioeconomic and sociodemographic correlates of HM use in Canada.[10] HM use is by no means a homogenous phenomenon. HM users in Canada tend to be female more often than male (Statistics Canada, 2005; Zhang, 2003; Goldstein, 2002; McFarland et. al., 2002; de Bruyn, 2001; Achilles et. al., 1999; Kelner & Wellman, 1997; Millar, 1997) and tend to be young to middle-aged (Statistics Canada, 2005; Zhang, 2003; McFarland et. al., 2002; de Bruyn, 2001; Achilles et. al., 1999; Blais, Maïga & Aboubacar, 1997; Kelner & Wellman, 1997). A 1999 survey found that 18 to 24 year olds were the most likely to have used HM, although 35 to 49 year olds were more likely to have consulted a provider for treatment (Ramsay et. al., 1999). Canadian HM users are less likely to be immigrants (Kelner & Wellman, 1997) and to identify with organized religions (Kelner & Wellman, 1997), but more likely to participate in new-age spirituality (Low, 2004). Still, as Low (2004) notes, "while participation in alternative spirituality may predispose one to explore alternative therapies, using alternative approaches to health and healing does not necessarily imply participation in alternative spirituality" (24). Users also tend to be White (Zhang, 2003; Goldstein, 2002; McFarland et. al., 2002), although individuals' multiple identities complicate definitions of race, ethnicity and culture, and decrease consensus about these correlations. What is more generally agreed upon in Canadian research is that Aboriginal peoples have lower health status than Canadians as a whole and are worse off socially and economically (Canadian Population Health Initiative, 2004); how this applies to the use of HM in the Canadian Aboriginal population is not known. It is known that use is higher among those with higher levels of education (Statistics Canada, 2005; Zhang, 2003; Goldstein, 2002; McFarland et. al., 2002; de Bruyn, 2001; Astin, 2000; Achilles et. al., 1999; Ramsay et. al., 1999; Blais et. al., 1997; Kelner & Wellman, 1997; Millar, 1997) and with higher incomes (Statistics Canada, 2005; Zhang, 2003; Low, 2004; de Bruyn, 2001; Achilles et. al., 1999; Blais et. al., 1997; Kelner & Wellman, 1997; Millar, 1997), although income, full-time employment and extended health insurance coverage determine more whether a person will consult a HM practitioner than whether or not they will use HM (de Bruyn, 2001; Ramsay et. al., 1999). Low's (2004) study of the subjective experience of the Canadian HM user found that cost complicated HM access for some participants; it does indeed seem that, "in market-based societies like Canada, income level is an important general marker of the capacity to pursue a good life" (Canadian Population Health Initiative, 2004: 43). In Canada, province of residence is a final, perhaps surprising, correlate of HM use; a provincial gradient exists showing high use of HM in Western provinces (Statistics Canada, 2005; Zhang, 2003; McFarland et. al., 2002; de Bruyn, 2001). Though it is estimated that 84% of British Columbians use a holistic therapy during their lifetimes, estimates are lower in Alberta (75%), Saskatchewan and Manitoba (79%), and Ontario (72%), and lowest in Quebec and the Maritime provinces, with only a respective 66% and 69% of residents accessing HM (Ramsay et. al, 1999). Millar (1997) posits that this gradient is due to different provincial insurance schemes, whereby coverage of chiropractics and other modalities is highest, albeit limited, in the West and in Ontario, with low coverage in Quebec and nearly no coverage in the Maritimes. Unlike access to biomedical services, access to HM has never been framed politically as a right of citizenship to be provided universally across provinces.

1.5. The Motivations for Using Holistic Medicine

While knowledge of the socioeconomic and sociodemographic correlates of HM use is certainly necessary, these correlates have limited power to explain the dramatic increase in consumer demand for HM. Since the 1970s, social scientists, armed with the knowledge that "social factors have a profound effect on both the experience and occurrence of illness", have been documenting the impact of a variety of social factors on people's health service choices (Giddens in Bury, 1997: 3). This research has yielded a number of hypotheses that seek to explain increasing HM use through the analysis of broader social determinants. These hypotheses fall into two categories, those proposing that negative aspects of biomedicine *push* consumers to use HM and those proposing that compelling aspects of HM *pull* consumers. Although it is too simplistic to posit that consumers are either *entirely* pushed or pulled to use HM – it is certainly both simultaneously – researchers are interested in the degree of HM use that can be explained by each body of theories (Furnham & Vincent, 2000) and whether one initially compels people to try HM while the other maintains their long-term interest (Low, 2004). Different theories could also be motivating different groups; as Tataryn and Verhoef (2001) point out:

> Each group – the concerned well, individuals with stress-related conditions, mental illness, infectious disease, acute illness or injury, long-term disability or handicap, chronic disease and the terminally ill – is unique in its needs and motivation for using CAM (93).

1.5.1. The Push of Biomedicine

Most studies on the increase in HM use attribute at least some of this growth to disenchantment with biomedicine, a result of increasing consumerism with respect to health combined with both an increasing sense of entitlement to a better quality of life and a growing prevalence of chronic disease (Gibson, 2003; Clark, 2000; Kelner, 2000). HM users are hypothesized to be dissatisfied in particular with biomedicine's limitations in dealing with chronic pain and illness (Low, 2004; Goldstein, 2002; Casey & Picherack, 2001; Clark, 2000; Millar, 1997) and with the paucity of biomedical strategies for promoting and maintaining wellness (Goldstein, 2002; Casey & Picherack, 2001). Other reasons for dissatisfaction include a declining faith that expertise and costly scientific and technological advances will be relevant for improving wellness, and the related fears of iatrogenic disease and risky or invasive treatments (Low, 2004; Turner, 2004; Clark, 2000; Taylor, 1985). Hypotheses also point to a deterioration of the doctor-patient relationship. With fewer generalists available, patients consult specialists who provide a decreasingly personalized service where silenced patients have less time and no option to choose another doctor (Low, 2004; Taylor, 1985). Han (2002) suggests that patients from minority cultural groups may consult HM providers because of a paternalistic intolerance of various cultural perspectives among biomedical practitioners. Lack of public trust and a general public preference for shared decision-making over paternalism are proposed to have led to pragmatic experimentation with holistic care (Kelner, 2000).

Support for these push hypotheses is varied. Evidence seems clear-cut in Low's (2004) conclusions that "people who took part in this research rarely identified ideological issues as reasons for their decisions to first seek out alternatives" (43) and that participants began to incrementally experiment with an expanding array of HM modalities and values only after initially being pushed by biomedicine (67). Sirois and Gick's (2002) study also demonstrates that medical need is a predictor of initial HM use, and dissatisfaction with conventional medicine is one of the key predictors of continued HM use. Still, while 31.8% of respondents in a 1995 survey supported the idea that disappointment with biomedicine was a motivating factor in HM use, this was less than the percentage of people who agreed that a desire to explore all possible health options or having had a previous good experience with HM were motivating factors (Ernst et. al. in Furnham and Vincent, 2000). Similarly, although de Bruyn (2001) and Furnham and Forey (1994) found that users of HM are more likely to be critical of physicians, only 20% of respondents in a 1999 survey agreed that holistic therapies were superior to biomedical ones and the majority of respondents in the same survey maintained confidence that biomedical practitioners could help them "manage their overall health" (Ramsay et. al., 1999: 12). Most researchers (Low, 2004; McFarland et. al., 2002; Achilles et. al., 1999; Ramsay et. al., 1999; Blais et. al., 1997; Furnham & Forey, 1994) found that HM users continue to consult biomedical practitioners, even if they make fewer visits to generalists (Blais et. al., 1997), often opt not to tell their doctors about their use of HM (Achilles et. al., 1999; Ramsay et. al., 1999), and have difficulty finding physicians who support HM use (Low, 2004). Astin's (2000) study of HM use among a national sample of American adults found that negative biomedical encounters did not predict HM use, and Kelner (2000) found that patients generally had good rapport with both HM and biomedical practitioners. Overall, HM appears to be used as a supplement rather than an alternative to biomedicine, which points to less support for the push hypotheses. Users tend not to reject biomedical models completely – they are not anti-science or anti-medicine, per se – but they are skeptical of the exclusive attitude of the dominant system and they frequently find that HM's conceptualization of human health as a complex matrix is both pragmatic and philosophically attractive.

1.5.2. The Pull of Holistic Medicine

Those who propose HM use is increasing due to its compelling ideologies implicitly posit that there is a growing effort in the population to prevent illness and maintain wellbeing. HM's empowering focus on building partnerships with users, such that users have control over their progress towards optimal health, is said to resonate with people who are seeking wellness (Gibson, 2003; Kelner, 2000). Indeed, the pursuit of wellbeing is often cited as a primary reason for HM use (Tataryn & Verhoef, 2001; Achilles et. al., 1999). One study found that 58% of HM treatments were intended to maintain wellness (Eisenberg et. al. in Tataryn & Verhoef, 2001: 93), while another reported that 81% of people chose HM, at least in part, for prevention of future illness and health maintenance (Ramsay et. al., 1999).

HM's value of holism is another posited draw for users (Casey & Picherack, 2001). O'Connor (2000) proposes that a significant number of people "find biology insufficient to adequately explain their own complex experiences of body and self" (52) and so these people are attracted to HM's postmodern outlook that rejects mechanistic explanations. Martin (2000) proposes that the ubiquitous image of the immune system gave rise to the popularity of the idea of the body as a complex system. Bunton and Burrows (1995) similarly elucidate the concordance of HM with popular ontological conceptualizations of the body as a project that needs to be "accomplished" as part of an individual's self-identity. Renewed interest in personal spirituality might be increasing the attraction of holism (Tataryn & Verhoef, 2001; Clark, 2000).

Social and political forces may also be contributing to the pull of HM. Goldstein (2002) discusses how the low cost of HM entices insurance companies, for whom it is more economical to cover HM modalities than biomedical ones. This perspective is congruent with Han's (2002) hypothesis that HM use is increasing because of its comparatively low costs. Of course, these hypotheses are particular to the United States, and do not apply in Canada where HM services are often not covered by provincial health insurance plans, and so usually cost more for patients who pay out-of-pocket. In both the United States and Canada, however, the movement of HM products into the mainstream retail industry is hypothesized to be pulling users towards HM. The pharmaceutical companies that now produce dietary supplements and natural medicines have large advertising campaigns that significantly legitimize HM use. Media bombard the public with the "consistent, if sometimes implicit, message ... that educated, middle-class people already use [HM]" (Goldstein, 2002: 54). Use of HM has also been attributed to the media's framing of HM modalities as "natural", a term users mistakenly conflate with "low risk" and "a lack of side effects" (Ernst, 2000), as well as to increased public access to worldwide health information on the Internet (Goldstein, 2002; Casey & Picherack, 2001; Tataryn & Verhoef, 2001; Clark, 2000; Valente, 2000). Valente (2000) employs theories of diffusion to demonstrate how HM use is gaining momentum as information spreads through social networks and media. The message that HM is trendy comes equally from an array of prominent social movements, including "those dedicated to enhancing the rights of women (feminism), gays, the elderly, and the disabled, as well as those built around the needs of people with specific diseases (AIDS, breast cancer, prostate cancer, etc.)"(Goldstein, 2002: 59). Part of the work of these movements "involves promoting health with both individuals and individuals within their community contexts" (Gibson, 2003: 178); HM values correspond well to this objective. The rhetoric of social movements informs HM to such an extent that it often becomes a sui generis space "where activists attempt to create and sustain an alternative way of life, especially through sharing information" (Goldner, 2004: 12). This space is replete with slogans "such as 'you are responsible for your own health', 'health is more than the absence of disease'" etc. that shape the identities of HM users (Goldner, 2004: 11; Hughes, 2004).

Pull hypotheses presuppose that HM users are differently knowledgeable about health compared to a biomedical clientele. In addition to having greater biological and physiological knowledge about the body (Furnham & Forey, 1994), HM users "have a greater awareness of preventive health practices such as reducing stress and getting proper sleep, and also report a larger number of good health habits" (Sirois & Gick, 2002: 1026). This health consciousness and literacy is hypothesized to materialize in feelings of more responsibility for one's own health (Tataryn & Verhoef, 2001; Mitchell & Cormack, 1998; Kelner & Wellman, 1997) and in more health-aware behaviours. Indeed, health-aware behaviour was one of the best predictors of continued HM use in Sirois and Gick's (2002) study. People in Kelner and Wellman's (1997) study similarly took a more proactive approach to health by exercising regularly, eating healthy foods, and taking vitamins, as did those in a Quebec study conduced by Blais (2000). HM users are also more likely to believe that their attitudes and actions impact their future health (Zhang, 2003; Kelner, 2000; Furnham & Beard, 1995), although this internal locus of health control is not associated with different coping styles (Furnham & Beard, 1995). HM's attractiveness to those relying on personal legitimacy for selecting appropriate care is not surprising, as empowerment to promote one's own wellbeing is central to these modalities (Gibson, 2003; Achilles, 2001). Given the parallels between HM and the health promotion movement,

> it is difficult to tell whether the difference in health awareness and behaviors was a product or a precursor of using CM. Moreover, if the health-aware habits promoted by CM are what motivate people to initially try CM, then this health awareness may also be a key motivator for continued CM use (Sirois & Gick, 2002: 1026).

Physical activity is a health-aware behaviour that is hypothesized to be strongly linked to the increasing popularity of HM. Health promotion and fitness are populist movements that pull users towards HM, particularly as the media increasingly presents all three as an integrated entity (Goldstein, 2000: 33; Crellin et. al., 1997). Goldstein (2000) proposes that "the growing emphasis being placed on fitness throughout Western societies is likely to be a major entry point to the world of CAM" (27). "Both serious efforts to remain fit, as well as much of the participation in CAM practices require a major, ongoing change in lifestyle" (Goldstein, 2000: 31). Fitness culture and HM also share crucial core elements, such as a broad and positive definition of health as a balanced state of wellness, an image of the holistic body as a source of reliable knowledge, a focus on transcending a current state of health by striving for something more, a belief in the centrality of nature to health processes and a corresponding ambivalence towards scientific and technological fixes, and a fundamental emphasis on individual responsibility for personal well-being (Keegan, 2001; Goldstein, 2000). The fitness industry re-theorizes selfhood such that, by "becoming fit, persons are said to achieve a degree of independence from medical professionals and medical technology" (Glassner, 1989: 187). Because of these compatible conceptions of health and the body, which are excluded from iconic biomedical discourses, people who adopt the perspectives of the fitness movement are, according to these hypotheses, readily able to rationalize HM use.

In short, there are a plethora of social factors relevant to the increase in HM use, and more and more of these contributing elements are being disentangled. It is clear from these hypotheses and from studies examining the multiplicative nature of motivating factors (Furnham & Vincent, 2000; Kelner & Wellman, 1997) that the choice to access HM services is complex and multidimensional, and that users are both being pushed towards and pulled by HM. Still, the respective contributions of different factors and the interactions between factors remain poorly understood, as most hypotheses have not been rigorously tested. Quantitative research on Canadian HM use, particularly longitudinal research, is still in early stages, and has been mainly limited to studies of users' socio-demographic profiles. This study narrows this gap in knowledge about the social factors that drive HM use. The hypothesis that fitness is a major contributor to the pull of HM is tested in a Canadian context.

1.6. Leisure-Time Physical Activity in Canada

Fitness is no simpler to define than the other concepts in this study. It is certainly not synonymous with health or wellness; "fitness can very well be connected with illnesses or sufferings" even though health and wellness do require a certain degree of fitness (Hollman, 1998: 1976). Fitness is defined as a "state of good physical and mental performance ability for a specific task" (Hollman, 1998: 1976). Such a concept is difficult to measure, however, and so most studies operationalize fitness by measuring physical activity. Physical activity is defined as "any bodily movement produced by skeletal muscles that [results] in energy expenditure" (Hendersen & Ainsworth, 2001: 23), and it can occur in all aspects of daily life, including occupational, sports, exercise, household, or other daily activities. Although measurement should ideally include all physical activity in a twenty-four hour day (Aadahl & Jørgensen, 2003), leisure-time physical activity (LTPA) surveys have been used since the mid-1960s to approximate total physical activity.[11] LTPA is the broad descriptor for the energy expenditure that accrues from the activities one participates in during free-time, based on personal interests and needs (Howley, 2001).

LTPA surveys generally use scales that allow "comparisons to be made across the continuum of exercise intensities, types of exercise and fitness levels" (Howley, 2001: S364). Exercise intensity is measured in units of metabolic expenditure, called METs, which are calculated as the ratio of the metabolic rate of the activity to a standard resting metabolic rate obtained during quiet sitting. In 1993, Ainsworth and her colleagues developed the Compendium of Physical Activity, a compendium of MET values for more than 600 specific activities, "to facilitate the coding of physical activities obtained from ... records, logs and surveys" (Ainsworth et. al., 2000: S498); this compendium was so well received in the exercise science and public health fields that it was updated in 2000 (Ainsworth et. al., 2000). The compendium provides average adult MET rates, which range from 0.9METs (sleeping) to 18 METs (running at 10.9mph). Intensity codes are a powerful tool for analyzing physical activity because, "unless a person engages beyond a certain level ... of vigorousness there is little or no impact" (Lüschen, 1998: 228). The sole limitation of working with intensity codes is that they do not take into account individual differences, like age, sex, body mass, and efficiency of movement, which can somewhat alter the energy costs of an activity (Ainsworth et. al., 2000; Lamb & Brodie, 1990).

Although it is only one aspect of physical activity, it is assumed (Lindström, Hanson & Östergren, 2001; Mensink, Loose & Oomen, 1997; Lamb & Brodie, 1990) that the relative importance of leisure-time physical activity in measures of total physical activity has obviously become greater over time as occupational physical activity has become nearly non-existent for the majority of North Americans. The assumption that LTPA can be used to approximate total physical activity is not unsound; research demonstrates that LTPA is associated with a wide variety of positive physical and mental health outcomes (Salmon, Hume & Ball, 2004; Droomers et. al., 1998; Aldana et. al., 1996), has positive short- and long-term effects on wellness (Gilmore, 2004; Lüschen, 1998), and is correlated with a longer lifespan (Kaplan et. al., 1996). At the same time, it is important to note that sociocultural contexts have a huge impact on participation in LTPA (Henderson & Ainsworth, 2001; Lüschen, 1998). "Leisure" is an unknown concept in some cultures and in others it has negative connotations of "doing nothing" (Henderson & Bialeschki in Henderson & Ainsworth, 2001: 24). While LTPA could be misestimated or underestimated in these cultures, it could be overestimated in cultures where an active lifestyle is highly desirable (Aadahl & Jørgensen, 2003; Droomers et. al., 1998).

High levels of LTPA are certainly prized in mainstream North American culture, and it is crucial to emphasize the significance of the health promotion movement in propelling this desirability of physical activity. Indeed, it is difficult, if not impossible, to disentangle one phenomenon from the other. Although it was

Claudios Galenos, a 2^{nd} Century Greek sports physician for the Roman gladiators, who first stated that exercise, gymnastics and sport would enhance health (Lüschen, 1998), the development of the health promotion movement per se is traceable in Canada to the 1974 release of Health Minister Marc Lalonde's report, *A New Perspective on the Health of Canadians*, about positive actions to promote health (in Bell, 2003). The timely release of the report occurred when health care was undergoing a dramatic discursive shift from a focus on intervention in disease to a focus on "health-related behaviours" (Bury, 1997: 9). "Health promotion" was officially defined in Canada in the 1986 *Ottawa Charter for Health Promotion* as "the process of enabling people to increase control over, and to improve their health" (in Bell, 2003: 24). Indeed, Ottawa is seen as the formal birthplace of health promotion (Catford, 2004). Since then, the movement has carefully distanced itself from biomedicine and subscribes to a more holistic conception of health as wellness that is akin to the perspective shared by HM and the physical fitness culture (Burrows, Nettleton & Bunton, 1995). Tones and Green (2004) suggest that the spirit of health promotion activities should be empowering, participatory, holistic, intersectoral, equitable, sustainable, and multi-strategy. In this paradigm, "the patient became a 'producer' of health through health-protective behaviour, a self-practitioner engaging in self-care" (Armstrong, 2002: 82). Individuals manage health roles in addition to sick roles! Legitimate targets for health promotion's preventative focus thus include entire lifestyles, or "the whole patterned range of activity, the entirety of locally available types of social and economic organization and the dominant beliefs, values and attitudes of people living their everyday lives" (O'Brien, 1995: 201). As O'Brien (1995) explains, the association between health and lifestyle that the movement has created,

> Is fundamentally a political achievement, supported by an institutionalized consumerism, validated by a liberal political ideology and nurtured by a technocratic professionalism increasingly oriented towards problem solving approaches to health and social life (193).

As they spotlight the facilitation of healthy lifestyles, health promotion activities should ideally be directed at promoting population health through improvements to health inequalities (Nettleton & Bunton, 1995). Individuals must be structurally *able* to live healthy lives before it becomes an individual choice to do so. Still, quantifiable, individualistic lifestyle outcomes that can result from simple policy changes are more attractive to stakeholders than health promotion strategies that focus on intangible concepts or distal health determinants. As such, physical fitness is a central foci of the health promotion movement, as it is politically palatable at the same time as the commitment to physical fitness likely also results to a certain degree from a larger commitment to a "healthy lifestyle".

Despite epidemic levels of obesity in Canada (Canadian Population Health Initiative, 2004; Gilmore, 2004) suggesting that a fitness culture is not pervasive, there is certainly a Canadian discourse of health promotion. Indeed, the official public health message in Canada is one of preventing chronic illnesses through healthy, risk-averse personal lifestyle choices, and the recently developed Integrated Pan-Canadian Healthy Living Strategy emphasizes three key areas: physical activity, healthy eating and healthy body weight (Health Canada, 2004). As part of the health promotion movement, physical culture has been made increasingly visible as individuals are constantly bombarded with ideas and images about the healthy body in culture (Kirk & Tinning, 1994). Although, of course, individuals interact critically with the idealizations of particular body types, Canadian health promotion efforts have not been in vain. A large majority of workplaces identify lack of exercise as a health concern of their organizations, and compensate by offering some sorts of wellness initatives to employees (National Wellness Survey Report, 2003).[12] On an individual level, more than two thirds of Canadians strongly agree that a healthy lifestyle, which includes being physically active, contributes to long-term health benefits (Canadian Fitness and Lifestyle Research Institute, 2002). Recent research (Canadian Fitness and Lifestyle Research Institute, 2004) indicates that Canadians, despite obesity levels, are more active in their leisure-time than twenty-years ago and that the Canadian fitness level has continued to increase over this period (while the American level has remained fixed). Between 1981 and 1995, the rate of participation in physical activity among adults rose from 21% to 37% (Active

Living Canada in Goldstein, 2000: 27), and the percentage of adults engaging in at least moderate LTPA also increased between 1994 and 1998 (Statistics Canada, 1999: 89). In 2000/01, 44% of Canadians reported being highly or moderately active during leisure time (Canadian Population Health Initiative, 2004). These increases have not been uniform across the country, however. A 2004 report on disparities in Census Metropolitan Areas (CMA) showed that physical activity was more frequent among CMAs in British Columbia, the Prairies, and northern Ontario (Gilmore, 2004). Victoria (64.5% active during leisure-time) and Vancouver (62.3%) had the populations with the highest participation in LTPA, whereas Sherbrooke (39.8%) and Chicoutimi-Jonquière (40%) had the lowest participation rates (Gilmore, 2004: 10). Data from the 2000/01 Canadian Community Health Survey (in Canadian Population Health Initiative, 2004) showed a similar fitness gradient. Barriers to LTPA in these areas could be either "internal", such as a lack of motivation or lack of leisure time, or "external", such as lack of funds to participate, lack of transport, or illness or disability (Lindström et. al., 2001: 448). Research from other countries indicates that LTPA is positively correlated with socioeconomic status (Lindström et. al., 2001; Droomers et. al., 1998; Johnson, 1998; Mensink et. al., 1997; Cohen et. al., 1991), urbanization (Mensink et. al., 1997), education level (Droomers et. al., 1998), and being White (Henderson & Ainsworth, 2001), and negatively correlated with age (Mensink et. al., 1997), body-mass index (BMI) (Mensink et. al., 1997) and being female (Henderson & Ainsworth, 2001). Paralleling the personality profile of health-literate people who use HM, it has been shown that people who engage in LTPA show overall health-aware behaviours and attitudes (Droomers et. al., 1998; Mensink et. al., 1997).

Although Canadian studies suggests that the nation is in fact responding favorably, if perhaps slowly, to health promotion campaigns and to the greater dissemination of health information generally, it is important to note that the hypotheses linking increased interest in HM with a growing culture of fitness are not by any means predicated on every citizen's subscription to this culture. Rather, as Goldstein (1992) points out, "despite the intense media interest and the immense sums expended on exercise and its attendant paraphernalia, serious involvement with exercise and fitness remains a minority phenomenon" (93). What is key for these hypotheses is that physical activity has become an integral part of health awareness, and indeed this has occurred in Canada as in the United States. Body making has become big business. In both countries, images of physical activity, energy and vitality are central tenets of popular discourses about illness prevention and bodily attractiveness, and the "contemporary citizen is increasingly attributed with responsibilities to ceaselessly maintain and improve her or his own health by using a whole range of measures," including physical activity (Bunton & Burrows, 1995: 208). It is therefore appropriate to test these hypotheses in the Canadian context.

Given this growing Canadian culture of wellness and fitness, this study analyzes the individual trajectories of holistic medicine users in order to identify the impact of physical activity on their usage. Health status is a critical variable in this analysis, as it is importantly related to both central variables. Individuals who report poorer health status are significantly more likely to use HM (Zhang, 2003; Astin, 2000). In particular, HM use is associated with chronic health conditions (Zhang, 2003; Kelner & Wellman, 1997; Millar, 1997) and HM users are more likely than non-users to report that their daily life is impacted by the health problems for which they are seeking treatment (Kelner & Wellman, 1997). Severe or chronic illnesses are also associated with lower levels of LTPA (Droomers et. al., 1998), but it is not known how other health statuses relate to physical activity. As Kelly and Field (1996) indicate, the negotiation of self-identity is mediated through the body in complex ways, and there is thus no simple causal relationship between bodily changes and health and lifestyle choices. Health status could potentially be operating as an intervening variable in the central relationship. On an individual level, it is very unlikely that engagement in the fitness movement precipitates immediate use of HM. Rather, changes in health beliefs are gradual and evolutionary. As Bury (1997) notes:

> Health beliefs are not invented anew by individuals on each occasion in which they arise, nor are they a set of rigid 'predispositions'. They are

> relatively stable entities, though reformulated and altered as events unfold over time or as new information is fed in (32).

Individuals who invest in their physical fitness, while perhaps increasingly compelled by the merits of HM, might experience increased health and thus choose not to consult any practitioners. In the language of the health-action model, the motivation of being injured or ill is lacking. Low levels of physical activity levels that subsequently reduce health status might lead users to try HM, and so cross-sectional analysis that simply links levels of physical activity and HM use might erroneously indicate that decreased physical activity is associated with increased HM use. Testing for an intervening effect of health status avoids this error.

Possible confounding effects of other lifestyle factors must also be tested in this analysis. Push hypotheses would be supported if a decreased engagement with the biomedical system is associated with increased HM use. An association between health-aware behaviours with regards to alcohol and tobacco use and both increased levels of physical activity and increased HM use would offer support for pull hypotheses of HM use.

Tracking individual patterns of physical activity and HM use over time is necessary for understanding the possible lag time between an engagement in fitness and the choice to use HM, and how health status and lifestyle factors might impact this relationship. It is already clear that support for fitness and HM is increasing on an aggregate level; analysis of individual trajectories of HM use over time will indicate whether these patterns are also connected at an individual level. Analyses of this sort that incorporate the concept of time into research are becoming increasingly common in the sociology of health. As Blaxter (2000) points out,

> Health is a characteristic where time cannot be ignored: the sociology of health is concerned with birth and death, ageing and the lifecourse, becoming ill and getting better, moving through both personal and historical trajectories. Health is neither simply a characteristic of the individual nor an event, but their meeting as they come together in biography (27).

1.7. Research Questions

This study explores the impact of physical activity on use of holistic medicine over time. In particular, the following research questions are addressed after adjusting for sociodemographic characteristics:

1. Are higher initial levels of physical activity associated with an increased likelihood of initial HM use and with an increased likelihood of using HM over time?
2. Do changes in individual levels of physical fitness over time, controlling for initial levels of physical activity, affect the likelihood of using HM such that increases in physical activity over time are associated with a greater likelihood of using HM? What is the dynamic nature of the trajectory between changing individual physical activity levels and HM use?
3. Does individual health status intervene in the dynamic relationship between physical activity and HM use?
4. Do lifestyle factors confound the relationship between physical activity and HM use?

NOTES

[1] See Armstrong and Armstrong (2003) for a discussion of the state of Medicare in Canada.
[2] Folk medicine refers to health traditions that rely on oral communication and that are practiced mostly out of the commercial sphere by non-specialists. It is found among all populations, despite the tendency in North America for it to be derogatorily associated with ethnic minorities (Hufford, 2002: 27). An example of folk medicine is the old wives' tale that exposure to cold temperatures predisposes one to getting a cold.
[3] A variety of justifications are offered in support of terminology choices. While Sirois & Gick (2002) use the term "complementary" to emphasize that these modalities are most often used in conjunction with biomedical services, Low (2004) uses the term "alternative" in order to emphasize how participants in her study conceptualized HM as an alternative to biomedicine. Gibson (2003) also uses the term "alternative", but justifies this choice by arguing that it most accurately represents the marginalized position of HM therapies in North American healthcare systems.
[4] Although Wood (1998) points out that no HM modality has succeeded in describing this subtle energy in empirical terms, he questions the usefulness of attempts to quantify the vital force and proposes that an explicit and scientific description would have little effect on the daily practice of HM.

[5] Rawson (in Tones & Green, 2004: 21) suggests that the biomedical model is "iconic" because it is a simplified description of one type of medical practice, although a number of deviations from this type occur in the actual practice of biomedicine.

[6] Armstrong and Armstrong (2003) document five assumptions that they propose are so integral to the Canadian biomedical system that they have become completely taken-for-granted. These assumptions are that the determinants of illness are primarily biological, that the body can be understood using a machine metaphor, that health care is about curing illness, that medicine is scientific, and that doctors are authorities and experts (18-22). Freund and McGuire (1999) identify five similar assumptions of the biomedical model: Cartesian dualism; physical reductionism that locates disease within the individual body; physiological etiology; understanding the body through a machine metaphor; and an emphasis on regimen and control of the body (212-214).

[7] For example, Birch (1998) examines acupuncture as a multimodal health system with competing explanatory models, and Swayne (1998) proposes that such diversity exists among homeopathic practices that it is difficult to define homeopathy as a coherent healing tradition.

[8] The term "art" is used here to indicate that the 19th century was a historical period of prescientific medicine.

[9] As Low (2004) points out, it is impossible to document the true number of HM practitioners because many forms of HM are unregulated, provided by individuals in small, private offices or in their own homes, and advertised and offered in conjunction with a variety of other services. If the number of known providers is increasing, however, it is reasonable to assume that the overall number of practitioners is growing correspondingly.

[10] The language about determinants or correlates of health and medical service use that is used here is from Gilmore's (2004) report. According to this report, socioeconomic correlates include education, employment and income variables, while sociodemographic correlates include cultural and ethnicity variables. Lifestyle and health correlates include smoking, alcohol use, blood pressure, body mass index, and physical activity variables, whereas phychosocial correlates include depression and stress variables and health system correlates include unmet medical needs and availability of medical providers. Other correlates of health and of medical service use can easily be added to these categories.

[11] On a practical note, while LTPA scales are problematic because they do not include occupational and household physical activity, scales measuring total physical activity would possibly be even more crude, given the difficulty of measuring physical activity during sleep, housework, employment, etc.

[12] Although this recognition is encouraging, unfortunately only 19.6% of organizations offering wellness initiatives actually offer a comprehensive wellness program, and even these organizations rarely offer physical activity initiatives (National Wellness Survey Report, 2003).

CHAPTER 2: Methods

2.1. Sample

The National Population Health Survey (NPHS) is a longitudinal study assessing the health status of the Canadian population. Statistics Canada began conducting the survey in 1994, with plans to continue for 20 years.[1] NPHS respondents were originally selected through a stratified two-stage design based on the sampling frame of the Labour Force Survey,[2] such that the data, when weighted, comprise a nationally representative sample of the Canadian population (excluding those residing on First Nations reserves, in long-term health care institutions, on Armed Forces bases, in the Yukon, Northwest Territories and Nunavut, and in some remote northern areas of Ontario and Quebec). The NPHS collects general information about all members of selected households as well as in-depth information about one randomly selected individual over the age of 12 per household; these randomly selected individuals (N=17,276) constitute the longitudinal panel. Although the survey was initially designed to accommodate cross-sectional as well as longitudinal inquiry, the cross-sectional component of the NPHS was transferred in 2000 to the then new Canadian Community Health Survey, and the NPHS became strictly longitudinal from Cycle 4 onwards.

This study uses the longitudinal full subset of the first four cycles of NPHS data, collected between 1994 and 2000. This complete subset consists of 13,582 individuals who were successfully traced and so participated in all four cycles, as well as those who died or were institutionalized subsequent to the first cycle of data collection. Attrition in this subset is due solely to non-response, to moves out-of-scope (i.e. out of North America) and to untraceable individuals. Due to extensive efforts to track panel members and strategies to reduce non-responses, the attrition rates by cycle are 9.3%, 6.7% and 7.1% respectively for Cycles 2, 3 and 4; the longitudinal full subset has a cumulative attrition rate of only 21.4% at Cycle 4.[3] This study narrows this subset by including only non-institutionalized adults over the age of 18 (N=9949). A further 6% of this narrowed sample is removed due to missing data on the variables of interest, resulting in a final sample size of 9343 respondents.

Although the NPHS has a considerable biomedical bias, data are collected on the "economic, social, demographic, occupational and environmental correlates of health" in order to further research on health determinants and facilitate health policy development (Population Health Surveys Program, 2002: 8). The survey thus assesses the frequency and quantity of respondents' participation in leisure-time physical activity as well as their use of HM products and services. In fact, one of the objectives of the NPHS is to "increase the understanding of the relationships between health status and health care utilization, including alternative as well as traditional services" (Population Health Surveys Program, 2002: 8). Another objective is to "provide information on a panel of people who will be followed over time to reflect the dynamic process of health and illness" (Population Health Surveys Program, 2002: 8); these objectives correspond readily to this study's research questions.

Data for this study were analyzed at the University of Alberta's Research Data Centre (RDC). RDCs are secure centres that house Statistics Canada microdata files, including the confidential NPHS data files required to link information about panel members across time and thus model the impact of changing levels of physical activity on the use of holistic medicine. These centres were established by Statistics Canada in collaboration with university consortia and with the Social Science and Humanities Research Council (SSHRC). As part of the Data Liberation Initiative, these centres were originally established to strengthen social policy research in Canada by improving academic researchers' access to microdata files (Statistics Canada, 2003). Researchers are eligible to use these data with approval from a SSHRC adjudication committee; a proposal for this study was submitted on April 5th, 2004, and approval for use of the NPHS data was received June 21st, 2004.

2.2. Measures

Modeling change requires four kinds of measures: 1) a subject identifier; 2) a measure of time; 3) an outcome, or dependent, variable; and 4) predictor, or independent, variables, including control and substantive predictors. Each NPHS respondent was assigned a permanent identification number in Cycle 1 and these subject identifiers are used in this study to link individuals across cycles. Time is coded 0 at initial interview and subsequent observations are measured as the number of years elapsed since the first interview. This is substantively appealing because the intercept can be meaningfully interpreted as the predicted level of HM use at initial interview, whereas the slope represents the average level of change in HM use during the period of observation. A quadratic term for time is also added to account for acceleration in the mean pattern of HM use over time. The time variable is calculated using the date of interview variables for each cycle. This metameter was chosen over age and cycle because it is recorded by trained interviewers and so is likely less prone than age to measurement error, and because it is measured in days and is therefore more precise than either of these other variables.

The outcome variable in this study is holistic medicine use, coded 1 for users and 0 for non-users. This use variable is created from three other dichotomous variables, such that a respondent is coded as a user if he or she consulted a chiropractor in the past 12 months, consulted another HM practitioner in the past 12 months, or uses HM health products. Although this coding is implicitly based on an ad hoc definition of HM that includes chiropractics and whichever other modalities an individual defines as belonging under this rubric, the NPHS only allows for residual definitions. The questionnaire initially filters respondents by asking, "People may also use alternative or complementary medicine. In the past 12 months, have you seen or talked to an alternative health care provider such as an acupuncturist, homeopath or massage therapist about your physical, emotional or mental health?" Respondents who answer yes to this question are subsequently asked to specify which practitioners, from a list that includes massage therapist, acupuncturist, homeopath or naturopath, Feldenkrais or Alexander teacher, relaxation therapist, biofeedback teacher, rolfer, herbalist, reflexologist, spiritual healer, religious healer and other. Individuals who respond positively to the initial filter question may use none of the listed HM modalities, and people who respond negatively to the initial filter question may actually use some of the listed modalities but not consider them to fall under the HM rubric. This study uses only the initial filter question because of these conceptual difficulties. This is in keeping with other research (Low, 2004; Gibson, 2003) finding that the only way to resolve the epistemological problem of defining HM is to label people as users if they so identify. The precise question asked about health products is: "There are many other health products such as ointments, vitamins, herbs, minerals or protein drinks which people use to prevent illness or to improve of maintain their health. Do you use any of these or other health products?" Although other studies using the NPHS (Zhang, 2003; Millar, 1997) do not include this question, the use of these products is included as part of this study's ad hoc definition of HM in order to recognize that HM is accessed in a plethora of ways, rather than only through consultations with HM practitioners. Given the widespread availability of an impressive array of HM products, studies that do not include people using HM products may be misclassifying an important number of HM users.

Physical activity is the substantive predictor variable of central interest in this study. NPHS respondents are asked in each cycle about the frequency and duration of their participation in sports and exercise activities over the previous three months. These responses are used to create a daily leisure-time physical activity index in which the time spent in each activity is weighted with a metabolic expenditure unit to give an absolute intensity of energy expenditure from daily LTPA (see Appendix A for a list of activities covered in the NPHS and their corresponding MET values).[4] This index is derived in the same way that Statistics Canada (2002) creates an index using these data,[5] except that this study's calculations are based on MET values obtained from the widely endorsed Compendium of Physical Activities (Ainsworth et. al., 2000). Higher index scores indicate higher levels of LTPA. Although the values of the index technically extend from a minimum of 0 MET/day (i.e. no daily physical activity) to a theoretical maximum of over 100 MET/day, there is not enough time in one day for a human to expend this much energy. Index scores in this study actually range from 0 MET/day to 33.95 MET/day. Statistics Canada (2002) classifies people with less than 1.5 MET/day as inactive, while those with between 1.5 and 3.0 MET/day have moderate levels of LTPA, enough that their health profits somewhat, and those with greater than 3.0 MET/day are active enough to benefit their cardiovascular health. The physical activity index is used to code two variables. Index scores from Cycle 1 are used to create a continuous level-2 variable for initial level of daily energy expenditure in LTPA. Change in physical activity is coded using a time-varying level-1 variable for the difference between index scores in Cycles 2 to 4 and the initial score in Cycle 1; this time-varying predictor is included because capturing change in physical activity is critical for the research questions.

This study measures health status with three substantive predictors: health utility index (HUI), activity restriction and number of injuries. Statistics Canada (2002) derives a health utility index score for each NPHS cycle. The HUI was developed at McMaster University's Centre for Health Economics and Policy Analysis in order to provide "a description of an individual's overall functional health, based on eight attributes: vision, hearing, speech, mobility, dexterity, cognition, emotion, and pain and discomfort" (Statistics Canada, 2002: 38-9). The index is intended to reflect social preferences about different health statuses. A score of 1.000 indicates perfect health, with a score of 0 indicating death and scores less than 0 indicating levels of health considered worse than death. This study uses two variables coded from this index. A continuous level-2 variable for initial HUI is coded from the index score in Cycle 1; this variable is centered on its grand mean and ranges from -0.360 to 1.000 in increments of 0.001.[6] A time-varying level-1 predictor measuring changes in HUI scores in Cycles 2 to 4 relative to initial status is also included so as to capture incremental changes in health. Change in restricted activity status is also captured in the coding. NPHS respondents are asked in each cycle about the presence of an activity restriction, that is, whether they have a long term disability or handicap, a physical or mental condition or a health problem lasting at least six months which limits them at home, school, at work or in other activities. Much like for HUI, a level-2 dummy variable for initial activity restriction, coded 1 if activity is restricted and 0 otherwise, is created from the Cycle 1 question, and a time-varying level-1 predictor is included to measure change in status in Cycles 2 to 4 relative to initial status. A respondent's number of injuries in the past 12 months is included as a time-varying predictor. As injuries are independent events, the probability of injuries is unlikely to be related to the occurrence of prior injuries. There is thus no substantive appeal to modeling initial injured status as a time-invariant predictor.

Lifestyle predictors are also included in this study to test for a possible confounding effect. A dummy variable for whether the respondent has a regular medical doctor at initial interview is coded 1 for yes and 0 for no. Initial alcohol use is also included as a level-2 variable, with dummy variables used for regular drinkers and occasional drinkers, and with non-drinker as the omitted reference group. A respondent's initial smoking behaviour is also captured in a level-2 variable that codes occasional and daily smokers as 1 and non-smokers as 0. A time-varying predictor is included for change in smoking behaviour, measured as the difference between smoking behaviour in Cycles 2 to 4 and initial smoking behaviour. This time-varying predictor is included, unlike in the cases of regular medical doctor and alcohol consumption behaviour, because anti-smoking campaigns have been a major focus of the health promotion movement, resulting in a dramatic decrease in Canadian smoking rates since the NPHS was introduced in 1994 (Canadian Population Health Initiative, 2004). Also, many HM modalities advertise that they can assist with smoking cessation, and so people who quit smoking may have already had an initial encounter with HM and may be particularly likely to use HM as part of their health-aware behaviours.

The model controls for measures of the documented sociodemographic and socioeconomic correlates of HM use (see Section 1.4). Time-invariant level-2 variables are included to control for sex, cohort, province of residence in 1994, Aboriginal status, immigrant status, and initial level of education. Sex is measured with a dummy variable, coded 1 for males and 0 otherwise. Age in 1994, measured continuously in years, controls for cohort differences in HM use (Zhang, 2003; McFarland et. al., 2002; de Bruyn, 2001; Achilles et. al., 1999; Blais, et. al., 1997; Kelner & Wellman, 1997) and is centered on its grand mean. Province of residence in 1994 is measured using dummy variables for the Maritimes, Quebec, Ontario and the Prairies, with British Columbia as the omitted reference category. Dummy variables are also included for Aboriginal and immigrant statuses, coded 1 respectively if the respondent identifies as a member of Canada's Native population or as an immigrant to Canada, and 0 otherwise. Millar (1997) notes that,

> Analyzing the use of alternative health care practitioners in national or provincial groups may conceal the fact that there are specific groups within the population for which alternative medicine is more prevalent. For example, the survey does not permit examination of acupuncture or herbalists by the Chinese community, or the use of traditional medicine by Canada's Native population (157).

Despite this valid concern, proportions of respondents in the NPHS from different racial and ethnic backgrounds are too small, and the categories other than Aboriginal North American too poorly defined, to include more variables in this analysis. Modeling race or ethnicity in a case like this would require applying crude racial and ethnic stereotypes to combine groups into seemingly homogenous categories that do not actually exist (Corin, 1994: 123). Participation in new-age spirituality is another known correlate of HM use (Low, 2004; Kelner & Wellman, 1997) that is not included in the models because no questions are asked about religion in the NPHS.

Statistics Canada (2002) derives education level in 1994 as a categorical variable with four levels, defined as a respondent's highest level of formal schooling. Dummy variables are used for less than secondary school, secondary school graduate, and some post-secondary schooling, with post-secondary graduate in 1994 as the omitted reference group. A level-2 variable is also included for household income, another known correlate of HM use, however a time-varying income variable is included as well to account for subsequent changes in income. Derived by Statistics Canada (2002) as a categorical level with 11 levels, income is defined as total household income from all sources in constant 2001 dollars and is transformed into a continuous variable that is centered on its grand mean. Cycle 1 values for this variable are used to create the level-2 variable for initial household income, and the difference between household income in Cycles 2 to 4 and this initial household income constitutes the time-varying level-1 predictor.

In addition to known correlates of HM use, two predictors for family roles (marital status and parental status) are also included, as is a predictor for urban or rural residence. Including these control variables implies hypotheses that Canadians with different marital and parental roles, as well as Canadians residing in different kinds of communities, make different health care choices. Marital status at initial interview is coded with dummy variables to compare married, common-law, widowed, and separated or divorced to those who are single in 1994 (the omitted reference group). A dummy variable is also included for whether there are children under the age of 25 living in the respondent's household in Cycle 1, coded 1 for the presence of children and 0 otherwise. This variable is derived from the Statistics Canada (2002) household type categories. Urban residency in 1994 is coded 1 for urban respondents and 0 for rural respondents; this dummy variable is derived by Statistics Canada (2002) using census geography.

2.3. Analysis

Modeling change is not possible with all datasets.[7] Firstly, longitudinal data are essential for modeling change. Making projections over time from cross-sectional data describing age-related differences among individuals conflates cohort with age effects; such generalization is inaccurate and misleading. Secondly, a minimum of three cycles of data must be available in order to model change. Analyzing only two cycles of data confounds true change and measurement error, making it impossible to discern whether change has actually occurred (Singer & Willett, 2003; Rogosa, 1995). Each additional cycle beyond this minimum strengthens the data and extends modeling possibilities. Finally, variables must be measured using identical questions in all cycles in order to capture change. As Singer and Willett (2003) point out, if "measures are not equatable over time, the longitudinal equivalence of the score meanings cannot be assumed, rendering the scores useless for measuring change" (14). This conviction is echoed in the statement:

> Seemingly minor differences across occasions – even those invoked to improve data quality – will undermine equality ... Although administering an identical instrument repeatedly can produce panel conditioning, empirical studies suggest that conditioning effects are small and their consequences pale when compared with those of measurement modification (Willett, Singer & Martin, 1998: 411).

As longitudinal NPHS data are currently available for the first four cycles of data collection and as questions on the variables of interest have been asked consistently throughout cycles, the NPHS is a suitable dataset for this analysis.

Questions about the passage of time are implicit to this sort of research about change, and such questioning can take two forms. While one class of questions "focuses on the occurrence and timing of events," the other asks about "the ways that individual attributes change over time" (Willett et. al., 1998: 396). This study is part of the latter class, and thus individual growth models are used to analyze how changes in HM use and physical activity are associated over time. Individual growth models are suitable for relating outcome variables to explanatory variables when one of the explanatory variables is a time component. The label "individual growth model" is a slight misnomer - although it implies growth, outcomes need only to change, and not necessarily to increase.

Individual growth models are part of the same family of models as multilevel models, mixed models, random coefficient models and hierarchical linear models. Studying change has only been a feasible option since the development of these models in the 1980s (Singer & Willett, 2003). Prior to this, researchers approached multiple cycles of data by plotting the means of the variables of interest over time, and erroneously attempted to measure change by correlating predictor variables with residualized change scores or with raw difference scores between initial and final measurements (Willett, 1997; Karney &

Bradbury, 1995). These approaches focus on "amounts" of change between discrete time points, and so ignore the constant nature of change; individual variability in change is also overlooked (Karney & Bradbury, 1995; Willett et. al., 1998). For research about change to explain differences in individual trajectories, the change must first be represented as a continuous process at the individual level. Individual growth modeling allows for just this.

From a statistical point of view, research questions about change over time always ask both a descriptive question – How can we characterize each person's individual growth trajectory? – and a relational question – How are these trajectories associated with different predictors? (Singer & Willett, 2003; Willett, 1997). Individual growth modeling can be thought of as a two-stage process where each stage or level addresses one of these questions. In the first stage,

> The outcome variable measured at each phase of data collection is regressed onto the time of measurement, *within* each individual in a sample. The result is an estimate, for each individual, of the trajectory of that person's change over time (Karney & Bradbury, 1995: 1098, emphasis in original).

The second stage treats the parameters of these individual trajectories as outcome variables and then uses predictors to explain the variability in individual trajectories, which are also called individual growth curves. This two-level method is very flexible. Because each individual growth curve is modeled independently, individual growth modeling "can accommodate any number of waves of data, the occasions of measurement need not be equally spaced, and different participants can have different data-collection schedules" (Willett et. al., 1998: 400).

The simplest and clearest way to postulate an individual growth model is first to posit a subsidiary model for each of the stages, referred to as level-1 and level-2 models, and then to integrate these models to obtain a composite model (Singer & Willett, 2003; Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). Many statistical software packages, including SAS (see below) require composite models.

2.3.1. The Level-1 Model

As the first stage of the analysis models within-individual change over time, the level-1 model specifies the individual growth trajectory. A basic trajectory is expressed in the equation: [8]

$$\begin{aligned} Y_{ij} &= \pi_{0j} + \pi_{1j}(TIME) + \varepsilon_{ij} \\ \varepsilon_{ij} &\sim N(0,\sigma^2) \end{aligned}, \qquad [2.1]$$

where Y_{ij} is the outcome for individual j at measurement occasion i; π_{0j} is the intercept of individual j's true growth trajectory; π_{1j} is the slope of individual j's true growth trajectory; and ε_{ij} is the level-1 residual, or error, across measurement occasions, which is assumed to be normally distributed with a mean of 0 and a variance of σ^2. This model can be elaborated to include time-varying predictors other than time, that is:

$$Y_{ij} = \pi_{0j} + \pi_{1j}(TIME) + \ldots + \pi_{nj}(X_n) + \varepsilon_{ij}, \qquad [2.2]$$

such that π_{nj} is a coefficient representing an instantaneous effect of level-1 predictor X_n on the slope of individual j's true growth trajectory. All level-1 coefficients can potentially be treated as random, which "means that the coefficient is permitted to vary across the units at the next higher level" (Kreft, de Leeuw & Aiken, 1995: 2). By definition, these instantaneous effects are not constant across the range of time, which is why these level-1 predictors are alternately referred to as time-varying variables. An unlimited number of these variables can be included in the model, however, adding predictors alters the interpretation of the individual growth parameters. When instantaneous effects are included in the level-1 model, the intercept parameter becomes a conditional parameter describing the expected value of Y_{ij} at the origin of time in j's true growth trajectory *when all time-varying variables are equal to 0.* Similarly, the slope parameter becomes a conditional rate of change, controlling for the impact of all time-varying effects.

The level-1 model can also be expanded by specifying different underlying temporal structures. While the level-1 model does constrain all individuals' trajectories to change over time according to the same function, any function can be used, in principle, to model change. Some researchers have explored modeling using polynomial, logistic, negative exponential, and nonlinear functions, among others, as underlying growth models (Karney & Bradbury, 1995). Still, as Willett et. al. (1998) point out, the majority of investigators fail to explore the possibility that non-linear temporal structures might provide the best models. The specification of an underlying temporal structure is not arbitrary; as Singer and Willett (2003) indicate,

> Adopting a parametric model for individual change allows us to re-express *generic* questions about interindividual differences in "change" as *specific* questions about the behavior of parameters in the individual models. If we have selected our parametric model wisely, little information is lost and great simplification is achieved (35, emphasis in original).

While selecting a linear model implies that each person's growth can be best described using just two parameters (i.e. the intercept and slope), a quadratic model, for instance, implies that a third parameter (i.e. an acceleration or deceleration in growth) is necessary to properly describe each person's true change. Adopting a quadratic model instead of the linear model of Equation 2.1 would look as follows:

$$Y_{ij} = \pi_{0j} + \pi_{1j}(TIME) + \pi_{2j}(TIME^2) + \varepsilon_{ij}, \qquad [2.3]$$

where π_{2j} is the rate of acceleration in individual j's true change trajectory. An underlying temporal structure should ultimately be chosen for substantive reasons, as determined by the researcher. In many cases, however, this is impossible for the practical reason that the number of cycles of available data limits the complexity of the temporal shape of the individual trajectory. A dataset must comprise at least one more time point than there are unknown parameters in the level-1 growth model (Willett et. al., 1998; Willett, 1997). In social science research where longitudinal datasets have few time points, relatively simple temporal structures in the level-1 model are often the only possibility.

2.3.2. The Level-2 Model

The second stage of the analysis models interindividual differences in growth trajectories; the level-2 model thus specifies the relationship between the shape of each individual's growth trajectory, and the time-invariant characteristics of that same individual.[9] As Singer and Willett (2003) point out,

> The ability to formulate this relationship using a level-2 submodel stems from the realization that adoption of a common level-1 submodel forces people to differ only in the values of their individual growth parameters (58).

As in the level-1 model, an unlimited number of level-2 predictor variables can be included in the model. With only one predictor variable, the level-2 model for linear Equation 2.1 is written as follows:

$$\begin{aligned}\pi_{0j} &= \beta_{00} + \beta_{01}(Z) + \mu_{0j} \\ \pi_{1j} &= \beta_{10} + \beta_{11}(Z) + \mu_{1j}\end{aligned}, \qquad [2.4]$$

where β_{00} is the grand mean of level-1 intercepts, for individuals where level-2 predictor Z is equal to 0; β_{01} is the grand mean difference in level-1 intercepts for a one-unit difference in predictor Z; β_{10} is the grand mean of level-1 slopes, for individuals where level-2 predictor Z is equal to 0; and β_{11} is the grand mean difference of level-1 slopes for a one-unit difference in predictor Z. When multiple predictors are included in the model, the level-2 intercept parameters are conditional on *all* predictors in the model being equal to zero. In the model, μ_{0j} and μ_{1j} are the level-2 residuals, which represent the part of the individual growth parameters that remain unexplained after accounting for the level-2 predictors. The residuals are assumed to be multivariate normally distributed with means of 0, respective unknown variances of τ_{00} and τ_{11} in true intercept and true slope across all individuals in the population, and unknown covariance τ_{01}. These assumptions can be summarized using matrix notation:

$$\begin{pmatrix}\mu_{0j} \\ \mu_{1j}\end{pmatrix} \sim N\left[\begin{pmatrix}0 \\ 0\end{pmatrix}, \begin{pmatrix}\tau_{00} & \tau_{01} \\ \tau_{10} & \tau_{11}\end{pmatrix}\right]. \qquad [2.5]$$

Including these residuals in the model formally recognizes that individuals who share common predictor values may still have different individual trajectories. In other words, the residuals allow for random deviations between the individual growth parameters and their respective population averages; as such, "their variances summarize the population variation in true individual intercept and slope around these averages" (Singer & Willett, 2003: 62). Similarly, the population covariance, which permits correlation between an individual's initial status and rate of change, summarizes the association between true individual intercepts and slopes.

In models with non-linear underlying temporal structures, any additional parameters must also be specified as level-2 outcome variables. The level-2 model for Equation 2.3 could look as follows, for instance:

$$\begin{aligned} \pi_{0j} &= \beta_{00} + \beta_{01}(Z) + \mu_{0j} \\ \pi_{1j} &= \beta_{10} + \beta_{11}(Z) + \mu_{1j} \; , \\ \pi_{2j} &= \beta_{20} + \beta_{21}(Z) + \mu_{2j} \end{aligned} \qquad [2.6]$$

where the effects for the quadratic parameter are interpreted as for the other parameters: β_{20} is the grand mean of level-1 accelerations, for individuals where level-2 predictor Z is equal to 0; β_{21} is the grand mean difference in level-1 accelerations for a one-unit difference in predictor Z; and μ_{2j} is a level-2 residual. Of course, all parameters can be specified more simply if this is a more substantively appealing option. Less complex level-2 models have the advantage of retaining a simpler covariance matrix. For example, if a quadratic equation has been selected because of an expected acceleration in growth over time in the given population, but there is little variation in acceleration and no substantive or statistical reason to posit that level-2 predictor Z would have an effect on acceleration, the parameter would be specified as follows:

$$\pi_{2j} = \beta_{20} \, , \qquad [2.7]$$

and the covariance matrix would be identical to the one posited in Equation 2.5.

The level-2 model must also specify models for the coefficients of any time-varying effects included at level-1. Models quickly become unwieldy if these instantaneous effects have complex specifications, and the most parsimonious models specify only one coefficient for each time-varying effect, as follows:

$$\pi_{nj} = \beta_{n0} \, . \qquad [2.8]$$

Constraining instantaneous predictors in this way implies that their effects are constant across population members.

2.3.3. The Composite Model

Regardless of the complexity of the level-1 and level-2 models, a composite model is obtained by substituting the level-2 model coefficients and parameters into the level-1 model. It is immediately evident in the composite model that "the outcome variable is simultaneously dependent on the time-variant and time-invariant predictors, as well as on the cross-level interactions of level-2 predictors with time." (Singer & Willett, 2003: 84). Integrating Equations 2.1 and 2.3 gives the composite individual growth model:

$$Y_{ij} = [\beta_{00} + \beta_{10}(TIME) + \beta_{01}(Z) + \beta_{11}(Z)(TIME)] + \mu_{1j}(TIME) + \mu_{0j} + \varepsilon_{ij}. \qquad [2.9]$$

The model can be divided into two parts. The fixed, or structural, part of the model represents the hypothesis about an individual's true trajectory of change. In Equation 2.9, the fixed part is contained within the square brackets. The random, or stochastic, part of the model describes the person's observed trajectory; this part is not shown in brackets.

2.3.4. Modeling Binary Outcome Data

It is crucial when postulating individual growth models to keep in mind that,

> Statistical models are mathematical representations of population behaviour; they describe salient features of the hypothesized process of interest among individuals in the target population. When you use a particular statistical model to analyze a particular set of data, you implicitly declare that *this* population model gave rise to *these* sample data. Statistical models are not statements about sample behaviour; they are statements about the *population process* that generated the data (Singer & Willett, 2003: 46, emphasis in original).

In cases where the outcome of interest is dichotomous, or binary, rather than continuous, and the variable can only take on one of two values for members of the target population, the standard level-1 model makes little sense. Although the predicted value of the binary outcome Y_{ij}, which is defined as the probability that $Y_{ij}=1$, must fall between 0 and 1, the standard level-1 model places no limits on the predicted outcome. In addition, the level-1 residuals cannot be normally distributed and cannot have homogenous variance in the case of binary data, which defies the assumptions of the level-1 model as expressed in Equation 2.1 (Snijders & Bosker, 1999). In other words, the model as presented thus far *cannot* adequately represent the population process!

The dilemma presented by binary outcome data is handled by linearizing the otherwise nonlinear model. In the language of the generalized linear model, a generalized model is used in the place of the hierarchical linear model, or the individual growth model, defined in the above equations. The hierarchical generalized linear model offers "a coherent modeling framework for multilevel data with nonlinear structural models and non-normally distributed errors" (Raudenbush & Bryk, 2002: 292) and can be applied to any model that satisfies these conditions.

This kind of modeling employs a link function to transform the predicted value of the level-1 outcome, and thus to linearize the underlying nonlinear structural model. In the case of binary outcome data, or a binomial sampling model, the logit transformation of the predicted value is a common and convenient link function (Raudenbush & Bryk, 2002; Raudenbush, 2001; Snijders & Bosker, 1999). This link function is denoted as follows:

$$\eta_{ij} = \log\left(\frac{\varphi_{ij}}{1-\varphi_{ij}}\right), \qquad [2.10]$$

where φ_{ij} is the probability of having an outcome of 1, and η_{ij} is thus the log of the odds of having an outcome of 1. Raudenbush and Bryk (2002) highlight that, while "φ_{ij} is constrained to be in the interval (0,1), η_{ij} can take on any real value" (295). This transformed predicted value, η_{ij}, is thus subsequently related to the level-1 predictors of the model, such that, for example,:

$$\eta_{ij} = \pi_{0j} + \pi_{1j}(\text{TIME}). \qquad [2.11]$$

Note that, unlike in Equation 2.1, there is no level-1 residual in this model. This is because, as mentioned above, there is no random variation in the case of dichotomous outcome data; any variation at level-1 that is not accounted for by the coefficients hinges entirely on the probability of having an outcome of 1. The level-2 residuals thus constitute the entirety of the random portion of the composite model. The level-2 model is unchanged in the case of binary outcome data. For such data, the composite model defined in Equation 2.9 would therefore be altered as follows:

$$\eta_{ij} = [\beta_{00} + \beta_{10}(TIME) + \beta_{01}(Z) + \beta_{11}(Z)(TIME)] + \mu_{1j}(TIME) + \mu_{0j}, \qquad [2.12]$$

again with the fixed part of the model in square brackets.

Because very few researchers are able to intuitively interpret coefficients expressed in the logit-scale, it is recommended that coefficients are transformed back to odds or probabilities for interpretation (Raudenbush & Bryk, 2002; Willett et. al., 1998). This transformation is easily computed using the following formula:

$$\varphi_{ij} = \frac{1}{1+\exp\{-\eta_{ij}\}}. \qquad [2.13]$$

2.3.5. A Taxonomy of Models

An individual growth model is postulated through an additive process that results in a systematized sequence of models that address the hypotheses (Raudenbush & Bryk, 2002). This is called a taxonomy of models, in which each model extends the previous one until a "final" model is posited.[10]

In developing a taxonomy, the unconditional individual growth model is the first to be posited. Although time is the sole predictor in this model, the selection of an appropriate unconditional model is critical. Two research choices are made at this stage: (1) the selection of an underlying temporal structure, and (2) the decision of how to code time. The first choice is dealt with above; suffice it to reiterate that this choice should be made taking both substantive appeal and the practical constraints of the number of time points into account. The second choice should be made solely for substantive reasons (Biesanz et. al., 2004; Singer & Willett, 2003). Person-period datasets usually contain many temporal variables, called metameters, that can be used to clock time. For example, age, age group, and cycle are all metameters. Not only does the researcher have a choice of metameters, but he/she can also choose to recode time in different ways by centering[11] or by altering the moment to define as time point zero. The choice of origin modifies all parameters except the highest order coefficient for time, which is unaffected by recoded time (Biesanz et. al., 2004). These transformations do not change the model test statistic – they alter the substantive interpretation but not the fit of the model. Accordingly,

> Because each coding of time can be viewed as providing a detailed snapshot or summary of the growth process at a particular point in time, time should be coded to focus attention and understanding where the primary substantive questions lie" (Biesanz et. al., 2004: 41).

Once the fitting of an appropriate unconditional growth model is complete, predictors are added to the individual growth model. Control predictors, whose effects the researcher wants to remove, should be fit before predictors that are of substantive interest. This initial fitting process, which tests for effects of variables that are changing less than the outcome variable, ensures "that attempts to determine correlates of change are meaningful" (Karney & Bradbury, 1995: 1105).

Control predictors can be added to either or both the level-1 and level-2 submodels. Fixed markers, like sex, cohort or ethnic heritage, are added as time-invariant level-2 predictors, as are other control predictors that change little over time and so can be adequately represented by their measurement on only one occasion. If a control variable used to account for differences in change over time also varies significantly with time, it cannot be suitably represented by a single measurement and so is added as a time-varying level-1 predictor (Karney & Bradbury, 1995). Both time-varying and time-invariant predictors can be centered on the sample mean, if this is a substantively meaningful option. If all level-2 predictors are centered on their grand means, the intercepts can be compared to those in the unconditional growth model.

After fitting controls, substantive predictors can be added to the individual growth model. As with control variables, these can be added as either level-1 predictors or level-2 predictors. For both substantive predictors added at this stage and control predictors added prior, Willett et. al. (1998) offer the advice to always test for interactions between predictors and time:

> When a predictor interacts with time, its impact on the outcome is different in different time periods. By exploring interactions with time, a researcher can determine whether a predictor's effect remains the same across the [time] span, or whether its effect fluctuates" (420).

As predictors are added to the unconditional growth model, successive models in the taxonomy are compared using the residual variance components to assess the amount of variability left after fitting the multilevel model, and thus after accounting for predictors. Ideally, residual variance should decline with the addition of both control and substantive predictors. Variance components can only be compared across models with identical sample sizes. In nested models, cases are removed from the analysis if they are missing values for the outcome variable or for any of the predictors in higher or lower taxonomical models.

2.3.6. Using SAS for Individual Growth Modeling

SAS statistical software version 9.1 was used in this study to execute all analyses. SAS is among a number of statistical packages that are suitable for individual growth modeling. Several SAS procedures can model multilevel, time-unstructured datasets and are flexible enough to model unbalanced data by employing a weight function whereby complete individual growth trajectories contribute more to the level-2 parameter estimates than those which are missing data.[12,13] As Singer (1998) cautions, however, having access to suitable software is insufficient for fitting appropriate models. Researchers must also understand how to communicate their models to the software and how to interpret the output. Although the SAS documentation is dense, a handful of kind researchers (e.g. Lix, 2004; Snijders & Bosker, 1999; Singer, 1998; Littell et. al., 1996) have detailed how particular procedures fit individual growth models as well as how to use these procedures.

Models in this study were fit using the GLIMMIX macro, which was originally coded in 1992 by the SAS Institute. The macro fits generalized linear mixed models using SAS's Mixed Procedure and Output Delivery System. As such, the GLIMMIX macro is not suitable for fitting all individual growth models, but rather only generalized models – those statistical models with "nonconstant variability and where the response is not necessarily normally distributed." (SAS Institute, 2004: 5). Random effects are assumed to be normally distributed in GLIMMIX. If this condition is fulfilled, GLIMMIX accommodates data distributed according to the binomial, normal, poisson, gamma and inverse gaussian distributions, as well as user-defined distributions. The default distribution is binomial, with a corresponding logit link function.

The GLIMMIX macro treats parameter estimation as an optimization problem and fits models based on linearization methods. These methods "employ expansions to approximate the model by one based on pseudo-data with fewer nonlinear components" (SAS Institute, 2004: 95). The algorithms in this group of methods are usually doubly iterative, such that a model of simpler (i.e. linear) structure is derived from the initial non-linear model. Parameters are then estimated for the approximated model using a singly iterative procedure. These new estimates for the simpler model are used to fit the model again and obtain even more precise estimates – this process continues and the estimates are gradually refined until the parameter estimates between successive models are sufficiently small to satisfy a predetermined criterion. Linearization methods are consistent and efficient. The disadvantage of a doubly iterative procedure, however, is the absence of a true log likelihood, and thus the inability to compare models using the -2log likelihood deviance statistic (SAS Institute, 2004).

Based on the structure of the model, the GLIMMIX macro selects an appropriate technique for estimating the parameters themselves.[14] The default technique in the GLIMMIX macro for models containing random effects is called restricted pseudo-likelihood estimation (REPL). The abbreviation "PL" indicates that the method is indeed a pseudo-likelihood technique where pseudo-data are created as part of the linearization algorithm. The term "restricted" indicates that the estimation is based on residual likelihood, as opposed to maximum likelihood. Likelihood estimation is the most popular approach to statistical estimation. Conceptually, these estimates are obtained by maximizing the logarithm of the probability of observing the particular sample as a function of the model's unknown parameters, in other words, by maximizing the log-likelihood function (Singer & Willett, 2003).[15] While maximum likelihood estimation maximizes the probability of observing the sample *data*, however, residual likelihood estimation maximizes the probability of observing the sample *residuals*.

The advantage of the latter default method is that it accounts "for the fixed effects in the construction of the objective [log-likelihood] function, which reduces the bias in covariance parameter estimates" (SAS Institute, 2004: 22). Still, users of the GLIMMIX macro are cautioned in the documentation (Wolfinger, 1998) that variance parameters might remain somewhat biased for longitudinal binary data with few repeats on each subject.[16]

2.4. Hypotheses

With an understanding of the structure of individual growth models, it is possible to reframe general research questions into more specific hypotheses about the key parameters of the individual change trajectory. As Singer and Willett (2003) point out,

> Rather than asking "Do individuals differ in their changes, and if so, how?" we can now ask "Do individuals differ in their intercepts? In their slopes?" To learn about the observed *average* pattern of change, we examine the sample averages of the fitted intercepts and slopes; these tell us about the average initial status and the average ... rate of change in the sample as a whole. To learn about the observed *individual differences* in change, we examine the sample *variances* and *standard deviations* of the intercepts and slopes; these tell us about the observed variability in initial status and rates of change in the sample." (35-6, emphasis in original).

The following hypotheses reframe this study's research questions:

1. Higher levels of energy expenditure during leisure-time physical activity at initial interview will be associated with greater intercepts for the odds of HM use at initial interview as well as with greater slopes for the odds of HM use over time.
2. Controlling for initial levels of physical activity, respondents who subsequently increase their LTPA energy expenditure will be more likely to use HM. Decreasing individual levels of physical activity relative to initial status will have the opposite association.
3. Respondents with lower health utility index scores at initial interview will be more likely to report HM use at initial interview. Controlling for initial HUI scores, respondents whose health status subsequently declines, that is their HUI scores drop relative to scores at initial

interview, will be associated with increased odds of HM use over time. Respondents whose activity is restricted at initial interview will similarly be more likely to be initial HM users. Controlling for this initial status, respondents who experience a change in activity restriction status, such that their activity becomes restricted, will have increased odds of HM use over time. Higher numbers of injuries will also be associated with increased odds of HM use over time. Taking the intervening effect of these three health status variables into account will increase the effect of LTPA energy expenditure on the odds of HM use.

4. If push hypotheses for increased HM use are sound, having a regular doctor at initial interview will be associated with lower odds of HM use at initial interview and a lower likelihood of HM use over time. Pull hypotheses suggest that lower initial levels of alcohol consumption and lower initial levels of smoking increase the odds of HM use at initial interview. Relative to their smoking status at initial interview, respondents who become smokers will be less likely to use HM and those who stop smoking will be more likely to use HM.

NOTES

[1] This document refers to particular NPHS cycles of data collection interchangeably by number and year of the cycle. For reference, the NPHS cycles and their corresponding years are as follows: Cycle1 – 1994/95, Cycle 2 – 1996/97, Cycle 3 – 1998/99, and Cycle 4 – 2000/01.

[2] An exception was made in Quebec, where Santé Quebec's 1992/93 Enquète Sociale de Santé's sampling frame was used to select panel members. For a complete explanation of the NPHS sampling and data collection procedures, see Chapters 5 and 6 of Population Health Surveys Program (2002).

[3] For a complete description of the NPHS response rates and attrition rates, see Chapter 8 of Population Health Surveys Program (2002).

[4] The index is calculated based on all variables in a given cycle, even if the variable is not consistent across all cycles. The rational behind this choice is that, if the variable "other contributes to the index, a respondent might include in this "other" category energy expenditure that was included under its own physical activity category in different cycles. For instance, if a respondent in Cycle 1 reports LTPA energy expenditure from yoga (which is removed in subsequent cycles) and then includes energy expenditure from continued participation in yoga in the "other" category in subsequent cycles, not including "yoga" in Cycle 1 would not allow for appropriate continuity. Including all variables as part of the scale compensates for changing

variables. Only the MET values of the 18 variables included across all four cycles are averaged, however, to obtain an average MET value for "other" variables.

[5] Like in the Statistic Canada (2002) derivation, this study's physical activity index does not take seasonal differences in LTPA into account. As data is collected across seasons and locations, it would complicate the analysis to take a measure of seasonal variation into account. This study therefore assumes that seasonal differences in LTPA are random.

[6] Kreft et. al. (1995) provide a detailed overview of the effects of centering variables. They differentiate between leaving predictors in raw score form, centering around the grand mean, and centering within context or around the group mean. They point out that the advantage of centering within context is that it "removes for a large part (but not totally) the confounding of slope and intercept variance" (10) but that the choice to center variables must ultimately be made for questions of substance and computational ease.

[7] See Rogosa (1995) for a detailed explanation of the characteristics required in a dataset in order to model change.

[8] Here and throughout this document, the notation used by Raudenbush (2001) is adopted. Other styles of equally clear notation are available (e.g. Singer & Willett, 2003; Raudenbush & Bryk, 2002, Snijders & Bosker, 1999).

[9] As Singer and Willett (2003) note, "The level-2 submodels do not describe the relationship between the parameter *estimates* and predictors, but between the parameters' *true values* and predictors" (63, emphasis in original).

[10] Singer and Willett's (2003) convention of putting quotation marks around the term "final" is adopted here. As they point out, no statistical model should ever be considered "final" (105).

[11] Biesanz et. al. (2004), who offer a systematic treatment of the impact of different choices of coding time in individual growth curve modeling, note that, while centering predictors is often recommended as the default in multiple regressions, this same logic does not hold for coding time.

[12] If cycles are identically spaced for all respondents, a dataset is time-structured, otherwise it is time-unstructured. If all respondents have the same number of cycles of data, a dataset is balanced, otherwise it is unbalanced. Although individual growth modeling is flexible enough to deal with time-structured or –unstructured as well as balanced or unbalanced data, models with time-structured, balanced data converge more quickly.

[13] This weighting process is entirely different from applying respondents' longitudinal weights in order to represent the entire population. Although applying longitudinal weights corrects for known distortion in the NPHS sampling procedure, such weights cannot be applied using GLIMMIX. This is not particularly problematic for this study, as individual change processes are analyzed rather than aggregate estimates.

[14] For an overview of estimation theory, see Chapter 14 of Raudenbush and Bryk (2002).

[15] For an explanation of why the logarithm of a likelihood function is maximized in place of the function itself, see Chapter 3 of Singer and Willet (2003).

[16] This bias is due to the fact that GLIMMIX uses penalized quasi-likelihood methods of inference rather than maximum quasi-likelihood methods. For a detailed explanation of the difference between these methods, see Breslow and Clayton (1993).

CHAPTER 3: Results

3.1. Patterns of Respondent Characteristics Over Time

In Table 1, descriptive statistics for holistic medicine use, physical activity, health status, lifestyle, sociodemographic, and socioeconomic variables are presented for respondents in each NPHS cycle, weighted so as to represent the Canadian population. The proportion of HM users increased steadily in each cycle, growing from 43.2% in 1994 to 52.3% in 2000. The proportion of those who use HM products increased across cycles and was high compared to proportions of both those consulting chiropractors and those consulting other HM practitioners, although both of these proportions also increased overall. Patterns of change in LTPA energy expenditure over time are more complex. Table 1 indicates that the aggregate rates of physical activity are fairly stable across time, with the mean LTPA energy expenditure increasing slightly over the first three cycles of data collection and then declining in Cycle 4.

The proportion of respondents reporting restricted activity and the means for health utility index and number of injuries vary little across the four cycles of measurement, which indicates little aggregate change in health status during this time period. The proportion of respondents who had a regular medical doctor also stayed stable over time, as did the proportions of those falling into the three different alcohol consumption categories (non-drinker, occasional drinker, regular drinker). The proportion of respondents who smoked cigarettes, however, decreased in each cycle from 1994 to 2001.

Table 1 indicates little aggregate change across time in the sociodemographic and socioeconomic characteristics of respondents. The proportion of males, Aboriginal North Americans, immigrants and urban residents are quite stable, as are the proportions of respondents with different levels of schooling, marital statuses, and provinces of residence. The proportion of households with children under the age of 25 declined between Cycle 1 and Cycle 4. The mean household income increased over the period of data collection.

3.2. Taxonomy of Individual Growth Models

Table 2 presents the unconditional model for individual trajectories of holistic medicine use (see Appendix B for the equation defining this model). This non-linear model postulates that the log odds of using HM are accelerating over time and thus that a quadratic curve adequately represents each person in the population's true change. It is assumed that deviations from this curve are due to random effects in initial status and growth rate only; no significant random effect for the quadratic term is postulated, based on preliminary analysis suggesting that it was not statistically significant.

Table 2 indicates that the average probability of HM use at initial interview is 38.3% (B_{00}=-.482, se=.030, $exp^{-.482}$=.617). Figure 1 illustrates that this average probability increases over time:

Figure 1: Probability of HM Use Over TIme

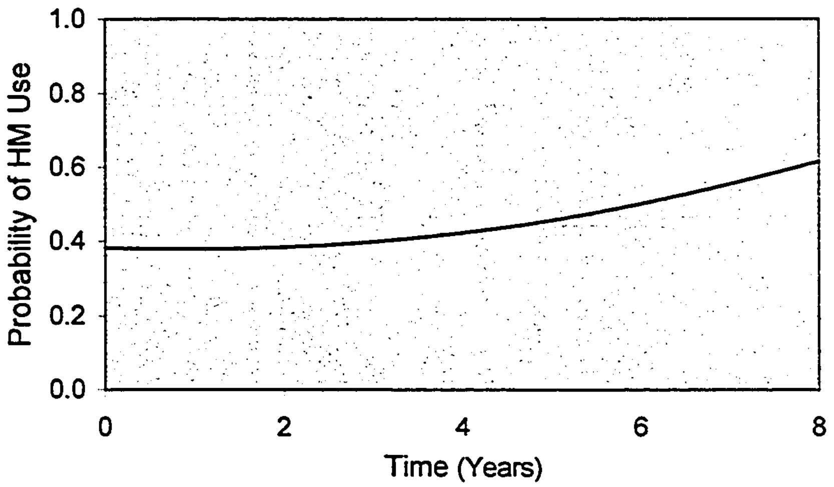

Table 3 presents a series of models that adjust for controls, test the central relationship between LTPA energy expenditure and HM use, and test alternative hypotheses. All variables are tested on both intercept and linear slope parameters, but not on the rate of acceleration because preliminary analysis indicated that these coefficients were not statistically significant.

3.2.1. The Correlates of Holistic Medicine Use

Model 1 illustrates the effects of sex, age in 1994, Aboriginal status, immigrant status, level of schooling, marital status, parental status, province of residence, urban residence, and household income on HM use. The model indicates that men have significantly lower odds than women of using HM at initial interview and are less likely than women to become HM users over time. Odds of initially using HM are also lower for Aboriginals and for immigrants, although the slope parameters are unaffected by these statuses. A moderately significant positive relationship between age in 1994 and initial HM use is present in the model, although age in 1994 has no impact on the linear rate of change.

The expected gradient exists in level of schooling such that those respondents with less years of formal schooling are significantly less likely to use HM at initial interview than respondents who are postsecondary graduates. The difference between this reference group and those with some postsecondary education is negligible, however. The model also indicates that having children in the respondent's household decreases the odds of being an HM user at initial interview by 34.0% (B_{012}=-.415, se=.065, p<.001, $\exp^{-.415}$=.660) compared to those who do not have children in the household. Relative to those who are single, those in other marital status categories do not have a significantly different likelihood of reporting HM use at initial interview. Neither level of schooling, marital status or parental status impact the linear rate of change.

As expected, a provincial gradient is evident in the model, such that those living in the Maritimes, Quebec, and Ontario have significantly lower odds of using HM at initial interview relative to those living in British Columbia. Being a resident of Quebec is associated with a flatter rate of change over time, such that the use of HM is increasing more slowly in Quebec compared with British Columbia. Individuals who live in urban locales are not significantly different than rural residents in their patterns of HM use at initial interview, nor does urban residency affect the linear rate of change. In contrast, household income does have a significant effect on both the intercept and slope, such that those with higher than average initial levels of household income are significantly more likely to be initial HM users and are marginally more likely to become HM users over time. Increases in household income relative to initial values are associated with an increased likelihood of using HM, while declining income is associated with a lower probability of using HM

3.2.2. Physical Activity and Holistic Medicine Use

Model 2 adds variables for physical activity to the control variables presented in Model 1. Higher levels of initial daily energy expenditure in leisure-time physical activity are positively associated with the intercept; each additional MET of initial energy expenditure increases the odds of being an initial HM user by 6.9% (B_{019}=.067, se=.012, p<.001, $exp^{.067}$=1.069), holding constant subsequent change in the level of LTPA energy expenditure. Controlling for initial LTPA energy expenditure, respondents who subsequently increase LTPA energy expenditure are more likely to use HM, while those who decrease physical activity are less likely to use HM. Thus, an increase of one MET in energy expenditure increases the odds of HM use by 6.3% (B_{40}=.061, se=.007, p<.001, $exp^{.061}$=1.063). However, initial levels of physical activity are not associated with the linear rate of change. Adding the physical activity variables in Model 2 does not alter the coefficients of the Model 1 control variables in substantively significant ways.

3.2.3. Accounting for Health Status and Lifestyle Factors

Model 3 includes three measures of health status: health utility index, restriction of activity, and number of injuries. A change in the magnitude of the Model 2 coefficient for LTPA energy expenditure would support an intervening role for health status in the central relationship between physical activity and HM use.

Controlling for subsequent change in health utility index scores, respondents with lower than average scores at initial interview are significantly more likely to be initial HM users. Controlling for initial HUI scores, respondents whose HUI scores decrease over time have higher odds of HM use, while those with increasing HUI scores reduce their odds of being an HM user. Initial health utility index scores have no impact on the linear rate of change. Respondents whose activity is restricted at initial interview are also more likely to use HM at initial interview, controlling for subsequent changes in activity restriction; again, this variable does not affect the linear rate of change.. Controlling for initial status, respondents whose activity becomes restricted over time have increased odds of becoming HM users. Finally, a respondent's time-varying number of injuries has a significant effect on HM use, such that the greater the number of injuries, the more likely it is that a respondent is an HM user. Including these health status variables in the model strengthens both the relationship between initial LTPA energy expenditure and initial HM use and the association between changing levels of physical activity and HM use, suggesting that health status has an intervening suppressor effect[1] on the central relationship.

Finally, Model 4 examines the extent to which three lifestyle factors, having a regular doctor, smoking behaviour, drinking behaviour, explain the central relationship (see Appendix B for the equation defining Model 4). Resultant changes in the Model 3 parameters would potentially add support to the push and pull hypotheses for increasing HM use.

Model 4 indicates that having a regular doctor has only a marginally significant impact on the odds of using HM at initial interview, and it does not impact the linear rate of change. The odds of being an initial HM user are higher for respondents who in 1994 indicate they are regular drinkers relative to non-drinkers. The odds of being an initial HM user are 26.3% (B_{023}= -.305, se=.063, $p<.001$, $\exp^{-.305}$=.737) lower for smokers than for non-smokers, controlling for change in smoking behaviours. Changes in smoking have a significant effect, such that respondents who take up smoking decrease their odds of HM use. Including lifestyle factors in this model explains 5.4% of the Model 3 coefficient for the effect of LTPA energy expenditure on the initial odds of being a HM user and 1.6% of the effect of changing energy expenditure on the odds of becoming a HM user over time:

$$\frac{(\beta_{019_{M3}} - \beta_{019_{M4}})}{\beta_{019_{M3}}} = \frac{(0.074 - 0.070)}{0.074} = 0.054 \qquad [3.1]$$

$$\frac{(\beta_{40_{M3}} - \beta_{40_{M4}})}{\beta_{40_{M3}}} = \frac{(0.064 - 0.063)}{0.064} = 0.016. \qquad [3.2]$$

Accounting for lifestyle factors also renders the effect of age in 1994 on the odds of initial HM use nonsignificant, and brings out a marginally significant effect of being divorced or separated on HM use, such that those with this marital status are more likely to use HM relative to those who are single.

NOTES

[1] An intervening suppressor effect occurs when adding a predictor variable to a given model *increases* the magnitude of the central relationship. This usually occurs when the predictor variable is positively associated with one of the central variables and negatively associated with the other (Aneshensel, 2002).

Table 1 Weighted Respondent Characteristics by Cycle
NPHS - LF Subsample, Cycles 1 to 4, Non-institutionalized adults (N=35630)

Respondent Characteristics	Cycle1	Cycle 2	Cycle 3	Cycle 4	Overall
Male	48.5	48.8	48.6	48.8	48.7
Age (years)	42.5(15.6)	44.3(15.3)	46.2(15.3)	48.0 (15.2)	45.2(15.5)
Race					
Aboriginal North American	0.56	0.56	0.56	0.50	0.55
Immigrant	20.0	19.6	19.6	19.7	19.7
Level of schooling					
Less than secondary school	23.0	21.3	20.9	19.5	21.2
Secondary school graduate	16.3	15.1	14.7	14.5	15.2
Some postsecondary	26.5	27.6	27.4	26.3	27.0
Postsecondary graduate	34.1	36.0	37.2	39.6	36.7
Marital status					
Married	60.4	60.8	60.9	61.3	60.8
Common-law	7.9	7.7	8.0	7.8	7.9
Single	19.6	18.0	15.9	14.6	17.1
Widow	4.6	5.0	5.7	6.0	5.3
Divorced or separated	7.5	8.5	9.6	10.4	8.9
Children in household	60.7	58.2	55.9	54.0	57.3
Province of residence					
Maritimes	8.4	8.5	8.4	8.5	8.5
Quebec	24.9	25.1	24.9	24.7	24.9
Ontario	38.3	38.0	38.1	39.0	38.3
Prairies	16.2	15.9	16.3	15.9	16.1
British Columbia	12.3	12.6	12.2	12.0	12.3
Urban	83.1	83.0	80.7	80.2	81.8
Household income (in $10,000)	4.59(2.52)	4.51(2.43)	5.01(2.60)	5.40(2.68)	4.87(2.58)
Smokes cigarettes	35.7	33.8	31.0	27.0	32.0
Drinks alcohol					
Non-drinker	18.4	18.3	19.2	18.1	18.5
Occasional drinker	20.1	21.1	20.2	19.5	20.2
Regular drinker	61.5	60.6	60.6	62.4	61.3
LTPA energy expenditure (Range 0 to 33.95)	2.06(2.43)	2.23(2.53)	2.42(2.58)	2.08(2.21)	2.20(2.45)
Level of LTPA*					
Inactive	54.2	50.5	46.2	51.5	50.6
Moderate	22.3	23.3	24.7	23.1	23.3
Active	23.5	26.2	29.1	25.4	26.0
Health utility index (Range -0.360 to 1.000)	0.87(0.18)	0.91(0.16)	0.89(0.18)	0.89(0.18)	0.89(0.18)
Number of injuries (Range 0 to 30)	0.23(0.75)	0.14(0.72)	0.13(0.61)	0.13(0.58)	0.16(0.67)
Activity is restricted	19.3	19.0	19.2	19.5	19.2
Regular medical doctor	86.5	87.3	87.3	88.9	87.5
HM user	43.2	43.3	46.1	52.3	46.2
Consults a chiropractor*	12.2	11.3	12.7	13.9	12.5
Consults an HM practitioner*	5.7	7.5	8.4	10.3	7.9
Uses HM products*	35.8	35.9	37.4	43.6	38.1
N (Total=9343)	9334	8842	8886	8568	35630

Numbers represent percentages and means (standard deviations in parentheses)
* Variable is not used in models

Table 2 Unconditional Individual Growth Model for HM Use
NPHS - LF Subsample, Cycles 1 to 4, Non-institutionalized adults (N=35630)

	HM Use		
Fixed Effect	*b*	*(s.e.)*	*Odds*
Mean initial status, β_{00}	-0.482	(.030)	0.617 ***
Mean growth rate, β_{10}	-0.033	(.016)	0.967 *
Mean acceleration, β_{20}	0.019	(.003)	1.020 ***
Random Effect	*Variance (s.e.)*		
Initial status, μ_{0j}	2.031	(.030)	***
Growth rate, μ_{1j}	0.293	(.006)	***

***p<0.001 **p<0.01 *p<0.05

Table 3A Taxonomy of Individual Growth Models for HM Use: Model 1 and Model 2
NPHS - LF Subsample, Cycles 1 to 4, Non-institutionalized adults (N=35630)

	Model 1				Model 2			
Fixed Effect	*b*	*(s.e.)*	*Odds*		*b*	*(s.e.)*	*Odds*	
Initial status, π_{0i}								
Intercept, β_{00}	0.999	(.137)	2.716	***	0.827	(.141)	2.286	***
Male, β_{01}	-0.633	(.057)	0.531	***	-0.655	(.057)	0.520	***
Age, β_{02}	0.007	(.002)	1.007	**	0.008	(.002)	1.008	***
Aboriginal North American, β_{03}	-0.998	(.343)	0.369	**	-1.048	(.344)	0.351	**
Immigrant, β_{04}	-0.260	(.086)	0.771	**	-0.252	(.086)	0.777	**
Level of schooling[1]								
Less than secondary, β_{05}	-0.560	(.080)	0.571	***	-0.544	(.080)	0.580	***
Secondary graduate, β_{06}	-0.453	(.086)	0.636	***	-0.454	(.086)	0.635	***
Some postsecondary, β_{07}	-0.114	(.072)	0.892		-0.108	(.073)	0.897	
Marital Status[2]								
Married, β_{08}	0.018	(.084)	1.018		0.043	(.085)	1.044	
Common-law, β_{09}	0.069	(.121)	1.072		0.093	(.121)	1.098	
Divorced or separated, β_{010}	0.201	(.111)	1.222		0.217	(.111)	1.242	
Widowed, β_{011}	0.049	(.141)	1.051		0.061	(.142)	1.063	
Children in household, β_{012}	-0.415	(.065)	0.660	***	-0.399	(.065)	0.671	***
Province of residence[3]								
Maritimes, β_{013}	-1.767	(.108)	0.171	***	-1.733	(.109)	0.177	***
Quebec, β_{014}	-0.608	(.111)	0.544	***	-0.572	(.112)	0.564	***
Ontario, β_{015}	-0.674	(.104)	0.510	***	-0.659	(.105)	0.518	***
Prairies, β_{016}	-0.187	(.106)	0.830		-0.166	(.106)	0.847	
Urban, β_{017}	-0.009	(.068)	0.991		-0.025	(.068)	0.976	
Household income, β_{018}	0.091	(.013)	1.095	***	0.088	(.013)	1.092	***
LTPA energy expenditure, β_{019}					0.067	(.012)	1.069	***
Activity restriction, β_{020}								
Health utility index, β_{021}								
Regular doctor, β_{022}								
Smokes cigarettes, β_{023}								
Drinks alcohol[4]								
Occasional drinker, β_{024}								
Regular drinker, β_{025}								
Linear Rate of Change, π_{1i}								
Intercept, β_{10}	-0.003	(.034)	0.997		-0.026	(.035)	0.975	
Male, β_{11}	-0.033	(.013)	0.968	*	-0.034	(.013)	0.967	**
Age, β_{12}	0.000	(.001)	1.000		0.000	(.001)	1.000	
Aboriginal North American, β_{13}	-0.061	(.077)	0.941		-0.054	(.077)	0.947	
Immigrant, β_{14}	0.005	(.019)	1.005		0.005	(.019)	1.005	
Level of schooling[1]								
Less than secondary, β_{15}	0.011	(.018)	1.011		0.013	(.018)	1.013	
Secondary graduate, β_{16}	0.014	(.019)	1.014		0.015	(.019)	1.015	
Some postsecondary, β_{17}	0.023	(.016)	1.023		0.023	(.016)	1.023	
Marital Status[2]								
Married, β_{18}	-0.025	(.019)	0.975		-0.027	(.019)	0.973	
Common-law, β_{19}	-0.051	(.027)	0.950		-0.054	(.027)	0.947	*

Table 3A (continued)	Model 1			Model 2		
Fixed Effect	*b*		*Odds*	*b*		*Odds*
Marital Status (continued)[2]						
Divorced or separated, β_{110}	-0.043	(.025)	0.958	-0.045	(.025)	0.956
Widowed, β_{111}	-0.045	(.032)	0.956	-0.046	(.032)	0.955
Children in household, β_{112}	0.0165	(.014)	1.017	0.018	(.015)	1.018
Province of residence[3]						
Maritimes, β_{113}	0.047	(.025)	1.048	0.050	(.025)	1.051 *
Quebec, β_{114}	-0.073	(.025)	0.929 **	-0.071	(.025)	0.932 **
Ontario, β_{115}	0.030	(.024)	1.030	0.032	(.024)	1.033
Prairies, β_{116}	-0.025	(.024)	0.976	-0.022	(.024)	0.978
Urban, β_{117}	-0.013	(.015)	0.987	-0.013	(.015)	0.987
Household income, β_{118}	0.008	(.003)	1.008 **	0.007	(.003)	1.007 *
LTPA energy expenditure, β_{119}				0.005	(.003)	1.005
Activity restriction, β_{120}						
Health utility index, β_{121}						
Regular doctor, β_{122}						
Smokes cigarettes, β_{123}						
Drinks alcohol[4]						
Occasional drinker, β_{124}						
Regular drinker, β_{125}						
Quadratic rate of change, π_{2j}						
Intercept, β_{20}	0.019	(.003)	1.019 ***	0.021	(.003)	1.021 ***
Change in household income, π_{3j}						
Intercept, β_{30}	0.041	(.009)	1.042 ***	0.040	(.009)	1.040 ***
Change in LTPA energy expenditure, π_{4j}						
Intercept, β_{40}				0.061	(.007)	1.063 ***
Number of injuries, π_{5j}						
Intercept, β_{50}						
Change in activity restriction, π_{6j}						
Intercept, β_{60}						
Change in health utility index, π_{7j}						
Intercept, β_{70}						
Change in smoking cigarettes, π_{8j}						
Intercept, β_{80}						
Random Effect	*Variance (s.e.)*			*Variance (s.e.)*		
Initial status, μ_{0j}	1.955	(.029)	***	1.962	(.029)	***
Growth rate, μ_{1j}	0.298	(.006)	***	0.298	(.006)	***

***$p<0.001$ **$p<0.01$ *$p<0.05$

[1] Reference cagtegory is "Postsecondary graduate"

[2] Reference category is "Single"

[3] Reference category is "British Columbia"

[4] Reference category is "Non-drinker"

Table 3B Taxonomy of Individual Growth Models for HM Use: Model 3 and Model 4
NPHS - LF Subsample, Cycles 1 to 4, Non-institutionalized adults (N=35630)

	Model 3			Model 4		
Fixed Effect	*b*	*(s.e.)*	*Odds*	*b*	*(s.e.)*	*Odds*
Initial status, π_{0j}						
Intercept, β_{00}	0.645	(.143)	1.905 ***	0.352	(.171)	1.422 *
Male, β_{01}	-0.661	(.058)	0.516 ***	-0.669	(.059)	0.512 ***
Age, β_{02}	0.006	(.002)	1.006 *	0.004	(.002)	1.004
Aboriginal North American, β_{03}	-1.076	(.346)	0.341 **	-1.014	(.346)	0.363 **
Immigrant, β_{04}	-0.220	(.087)	0.803 *	-0.213	(.087)	0.808 *
Level of schooling[1]						
Less than secondary, β_{05}	-0.572	(.081)	0.564 ***	-0.511	(.081)	0.600 ***
Secondary graduate, β_{06}	-0.436	(.087)	0.647 ***	-0.408	(.087)	0.665 ***
Some postsecondary, β_{07}	-0.132	(.073)	0.876	-0.113	(.073)	0.893
Marital Status[2]						
Married, β_{08}	0.066	(.085)	1.068	0.066	(.085)	1.068
Common-law, β_{09}	0.116	(.122)	1.123	0.164	(.122)	1.178
Divorced or separated, β_{010}	0.189	(.111)	1.208	0.221	(.112)	1.247 *
Widowed, β_{011}	0.107	(.142)	1.113	0.125	(.143)	1.133
Children in household, β_{012}	-0.389	(.065)	0.678 ***	-0.374	(.065)	0.688 ***
Province of residence[3]						
Maritimes, β_{013}	-1.722	(.109)	0.179 ***	-1.700	(.109)	0.183 ***
Quebec, β_{014}	-0.501	(.113)	0.606 ***	-0.481	(.113)	0.618 ***
Ontario, β_{015}	-0.668	(.105)	0.513 ***	-0.677	(.105)	0.508 ***
Prairies, β_{016}	-0.156	(.106)	0.856	-0.146	(.106)	0.864
Urban, β_{017}	-0.032	(.068)	0.969	-0.033	(.068)	0.968
Household income, β_{018}	0.104	(.013)	1.109 ***	0.090	(.013)	1.094 ***
LTPA energy expenditure, β_{019}	0.074	(.012)	1.076 ***	0.070	(.012)	1.072 ***
Activity restriction, β_{020}	0.548	(.075)	1.729 ***	0.558	(.076)	1.746 ***
Health utility index, β_{021}	-0.500	(.165)	0.606 **	-0.556	(.166)	0.573 ***
Regular doctor, β_{022}				0.170	(.087)	1.186 *
Smokes cigarettes, β_{023}				-0.305	(.063)	0.737 ***
Drinks alcohol[4]						
Occasional drinker, β_{024}				0.112	(.088)	1.118
Regular drinker, β_{025}				0.297	(.077)	1.346 ***
Linear Rate of Change, π_{1j}						
Intercept, β_{10}	-0.006	(.036)	0.994	0.005	(.042)	1.005
Male, β_{11}	-0.034	(.013)	0.966 **	-0.028	(.013)	0.973 *
Age, β_{12}	0.000	(.001)	1.000	0.000	(.001)	1.000
Aboriginal North American, β_{13}	-0.057	(.078)	0.945	-0.058	(.078)	0.944
Immigrant, β_{14}	0.002	(.020)	1.002	-0.001	(.020)	0.999
Level of schooling[1]						
Less than secondary, β_{15}	0.016	(.018)	1.016	0.013	(.018)	1.013
Secondary graduate, β_{16}	0.014	(.019)	1.014	0.013	(.020)	1.013
Some postsecondary, β_{17}	0.026	(.016)	1.026	0.024	(.016)	1.024
Marital Status[2]						
Married, β_{18}	-0.028	(.019)	0.972	-0.031	(.019)	0.969
Common-law, β_{19}	-0.058	(.027)	0.944 *	-0.058	(.027)	0.943 *

Table 3B (continued)	Model 3			Model 4		
Fixed Effect	*b*		*Odds*	*b*		*Odds*
Marital Status (continued)[2]						
Divorced or separated, β_{110}	-0.044	(.025)	0.957	-0.044	(.025)	0.957
Widowed, β_{111}	-0.051	(.032)	0.950	-0.054	(.032)	0.948
Children in household, β_{112}	0.0145	(.015)	1.015	0.013	(.015)	1.013
Province of residence[3]						
Maritimes, β_{113}	0.051	(.025)	1.052 *	0.049	(.025)	1.050 *
Quebec, β_{114}	-0.075	(.026)	0.928 **	-0.075	(.026)	0.928 **
Ontario, β_{115}	0.036	(.024)	1.037	0.036	(.024)	1.036
Prairies, β_{116}	-0.022	(.024)	0.979	-0.022	(.024)	0.978
Urban, β_{117}	-0.013	(.015)	0.987	-0.012	(.015)	0.988
Household income, β_{118}	0.007	(.003)	1.007 *	0.007	(.003)	1.007 *
LTPA energy expenditure, β_{119}	0.005	(.003)	1.005	0.005	(.003)	1.005
Activity restriction, β_{120}	-0.029	(.018)	0.971	-0.030	(.018)	0.971
Health utility index, β_{121}	0.021	(.039)	1.022	0.024	(.039)	1.024
Regular doctor, β_{122}				0.004	(.019)	1.004
Smokes cigarettes, β_{123}				-0.008	(.014)	0.992
Drinks alcohol[4]						
Occasional drinker, β_{124}				0.010	(.020)	1.010
Regular drinker, β_{125}				-0.022	(.017)	0.978
Quadratic rate of change, π_{2j}						
Intercept, β_{20}	0.019	(.003)	1.019 ***	0.019	(.003)	1.019 ***
Change in household income, π_{3j}						
Intercept, β_{30}	0.044	(.009)	1.045 ***	0.041	(.009)	1.042 ***
Change in LTPA energy expenditure, π_{4j}						
Intercept, β_{40}	0.064	(.007)	1.066 ***	0.063	(.007)	1.065 ***
Number of injuries, π_{5j}						
Intercept, β_{50}	0.128	(.019)	1.137 ***	0.129	(.019)	1.138 ***
Change in activity restriction, π_{6j}						
Intercept, β_{60}	0.340	(.048)	1.405 ***	0.344	(.048)	1.411 ***
Change in health utility index, π_{7j}						
Intercept, β_{70}	-0.406	(.104)	0.667 ***	-0.421	(.105)	0.656 ***
Change in smoking cigarettes, π_{8j}						
Intercept, β_{80}				-0.155	(.060)	0.857 **
Random Effect	*Variance (s.e.)*			*Variance (s.e.)*		
Initial status, μ_{0j}	1.968	(.029)	***	1.965	(.029)	***
Growth rate, μ_{1j}	0.301	(.006)	***	0.301	(.006)	***

***$p<0.001$ **$p<0.01$ *$p<0.05$

[1] Reference cagtegory is "Postsecondary graduate"

[2] Reference category is "Single"

[3] Reference category is "British Columbia"

[4] Reference category is "Non-drinker"

CHAPTER 4: Discussion and Conclusions

This study was originally conceived to address differences over time in Canadians' use of holistic medicine. Specifically, it was expected that patterns of HM use would be associated with different levels of engagement in the fitness movement, which was indeed found. The results support Goldstein's (2000) hypothesis that people with higher levels of physical activity are significantly more likely than those with lower levels to be HM users.

It was also expected that differences in health status and lifestyle factors would contribute to explaining this relationship. The results support the hypothesis that health status intervenes in this relationship and has a suppressor effect, suggesting that were it not for the poorer health status of those using HM, the effect of physical activity on HM use would be even stronger. The marginally significant findings for the predictor of having a regular doctor offer little support for the theory that individuals are pushed by biomedicine into using HM, suggesting that Canadians use HM and biomedicine concurrently rather than as alternative health-seeking strategies. In contrast, the results for the smoking variables do offer modest support for theories proposing that the central tenets of HM pull users. These results indicate that physical activity is part of a more generalized health awareness that instigates and sustains HM use.

Given the role of the health promotion movement in encouraging fitness and health awareness in general, these pull theories can be reconceptualized as a second type of *push* theories. Rather than a negative experience with biomedicine pushing individuals to use HM, the health promotion movement is the propelling force! Individuals who internalize the messages of health promotion, including an outlook about wellness that involves "more acceptance of personal responsibility for improving health and wellbeing, and a greater awareness of the implications of health-related behaviours," proceed to take responsibility through other means, including HM use (Stewart, 2004: 276). Access to HM becomes integral to the expression of health-aware attitudes. This access can therefore be considered a determinant of health, in that those who are denied access while still being exposed to the ubiquity of health promotion messages have a limited ability to pursue wellness writ large. The link between health promotion and HM use through the physical fitness movement has two implications that are of interest for policymakers. It may be speculated that this association could result in further individualizing health as well as in fostering the integration of HM and biomedicine.

4.1. The Individualization of Health

Health promotion has been criticized for approaching health from a perspective that blames individual victims of illness for their personal failure to maintain their health (Davison & Smith, 1995; Donahue & McGuire, 1995; Marmor et. al., 1994; McLeroy et. al., 1988). Under this paradigm, individuals are held accountable for healthy, and by necessity, unhealthy lifestyle choices, including choices about smoking, drinking alcohol, eating habits, exercise and stress, among others. Consumption plays an important role in this individualizing process. As various commodities and activities are reformulated as either "health-builders" or "health-wreckers", a health-aware identity coalesces around the consumption of the former (Nettleton & Bunton, 1995). As Hendersen and Petersen (2002) describe, the "'good consumer' of health care is compelled to make choices, to exhibit appropriate 'information-seeking' behaviour, and to behave in certain prescribed ways" (3).[1] Health is packaged as a particular "lifestyle" to be consumed (Bunton & Burrows, 1995; O'Brien, 1995); rhetoric of personal empowerment underlies this choice.

The danger of this individualistic paradigm is that it can be read as a justification for various types of retrenchment[2] of health and social programs. Reframing health as an entitlement of those individuals who make the "right choices", rather than a universal right of citizenship, allows for privatization[3] and the erosion of shared responsibility. Individuals are pushed to the hidden health care system of the home, to community services, and to private companies, where services are paid for out-of-pocket. As Hughes (2004) proposes, "the participative patient becomes an informal 'worker'" for the health care system

(43). Individualizing the burden of maintaining health and wellness thus bolsters the neo-liberal agenda that currently dominates Canadian health service reform. This agenda borrows discourses from the marketplace to argue that individuals are more effectively able to provide health and social supports than the state (Sullivan & Baranek, 2002; Rice & Prince, 2000; McDaniel & Chappell, 1999: 124). Although this agenda may strongly influence the population's perception of their own health responsibilities, it does not correspondingly effect the necessary social and environmental change to structurally empower people to satisfy their health needs and thereby satisfy society's expectations (Donahue & McGuire, 1995). Attention is deflected from broader determinants of health and people are pushed away from the public health care system. At the same time, low-cost, individualistic health promotion strategies create the appearance that governments are heavily involved in population health (Marmor et. al., 1994).

Although the health promotion movement endeavors to break free from such a notoriously ineffective approach[4] (Catford, 2004; Tones & Green, 2004; Bell, 2003; MacDonald, 2003; Evans & Stoddart, 1994; McLeroy et. al., 1988), this individualizing paradigm continues to lurk in policy discourse. If not carefully applied, the association between health-awareness and holistic medicine found in this study has the potential to exacerbate this tendency. Although becoming involved in the physical fitness and holistic medicine movements appear to be free choices in this quantitative analysis, it needs to be emphasized that these "choices" are heavily constrained by social and environmental determinants. This study is not meant as a tool for reinforcing the structural differences in access to quality health services by constructing those in poor health as individually culpable. Rather, these results should be read as a demonstration of how health-aware individuals who are frequent HM users experience a heavy burden of private health costs. Health promotion policies that effectively promote a holistic paradigm, while at the same time keeping private HM services inaccessible to many Canadians, are contradictory and contrary to both the spirit of the Canada Health Act and the mission of Health Canada.[5]

4.2. The Integration of Holistic Medicine and Biomedicine

The results of this study can also be read as offering a bridge between holistic medicine and biomedicine. Health promotion, which of course encompasses strategies for increasing physical fitness, tends to fall under the purview of the formal biomedical system. This study, however, demonstrates its association with HM, which supports the idea that a philosophical basis upon which to integrate the two systems could be developed. Health promotion rhetoric could be used to mediate a reconfiguration of power in health services. Policy debates need not be framed in the dualism of either supporting HM *or* biomedicine; although they currently lack dialogue, the two systems are not incommensurable.

The possibility of integration of HM and biomedicine has become a hotly debated topic in health care as the distinctions between HM and biomedicine have become less pronounced (Schaffner, 2002; Sharma, 2000; Crellin et. al., 1997). The tremendous public interest in HM has also led to a call from a number of HM and biomedical practitioners to bridge the two systems (Tataryn & Verhoef, 2001; WHO Centre for Health Development, 2000; Achilles et. al., 1999). They argue that the development of one coordinated and transparent wellness system would be a means of reducing barriers to HM use, including stigma, lack of funding and lack of support from doctors (Low, 2004), and would also lead to increased safety and decreased costs (Tataryn & Verhoef, 2001; Marmor et. al., 1994). HM users are also calling for integration with the dominant system. The majority of respondents in Goldner's (2004) study believed that this was the ultimate goal of the HM movement. Proponents of integration argue that, although HM has not achieved full politico-legal legitimacy per se,[6] integration abounds at the micro level as individuals blend the use of HM and biomedical modalities. As the findings of this study suggest, Canadians are combining modalities from the two systems rather than using them in isolation. This change in the way the population encounters health care creates a momentum for systematic integration. Tataryn and Verhoef (2001) propose that policymakers cannot ignore this "upward pressure" of consumer demand, particularly when the dominant rhetoric is the individualistic construction of health described above (97).

The call for integration from biomedical professionals is sometimes based on the paternalistic idea that these practitioners have an ethical responsibility to oversee HM and that, if they do not meet this obligation, they are compliant in any harm that befalls the patients they are bound to protect (Clark, 2000: 449). They argue that the potential for harm increases as more citizens use HM, and governments must therefore integrate these services into legitimate regulatory systems in order to protect people who cannot necessarily determine on their own what is unsafe or low-quality treatment. Even the World Health Organization (2001) officially "encourages and supports Member States to integrate traditional and complementary/alternative medicine into national health care systems and to ensure their *rational* use" (4, emphasis added). From this perspective, the dilemma for biomedical practitioners is not about creating balance or improving wellness, but rather about "whether to embrace alternative medicine or to become increasingly removed from a major part of their patients' healthcare" (Coulter, 2004: 118).

Proponents of integrative medicine caution that successful integration will not result from an additive process whereby HM modalities are engulfed by the dominant biomedical system. Integration cannot be a defensive strategy feeding the biomedical community's hunger for control. Rather, it must emerge from an acknowledgement that biomedical epistemology is but one knowledge system (Good, 1994: 3) and that, while biomedicine succeeds dramatically in many areas, it alone is inadequate to address the ultimate goal of wellness (Jonas, 2002; Tauber, 2002). As Swayne (1998) so insightfully states, "The practice of medicine or any branch of health care should be an adventure in holism" (65).

Although the current coexistence of the two systems, rife with mistrust and stifled knowledge, is tense both for users and practitioners, poor integration that assimilates HM would not necessarily be preferable to this status quo (Goldstein, 1999). Collyer (2004) describes HM's mainstreaming in Australia, where HM services have been co-opted by the hegemonic biomedical system, resulting in a loss of autonomy for HM practitioners and increased costs for all. As she points out in this cautionary tale,

> It is very clearly a cooption of CAM, not an amalgamation of philosophies or knowledges. There is little evidence that the mainstreaming of CAM represents an undermining of the hegemonic medical model of illness, nor is it a challenge to scientific practice and the major institutions. The mainstreaming process is neither an equal partnership between the two systems nor a reformulation of the health system. (Collyer, 2004: 94).

A similarly poor integration in Canada would revert back to the golden age of biomedical dominance, when HM modalities were hidden and stigmatized. As Canadians readily use HM to create wellness, reconstructing barriers to HM use is obviously not desirable.

Bell (in Coulter, 2004) suggests that integration "represents a higher order system of care that emphasizes wellness and healing of the entire person" as primary goals (117). The challenge is to avoid the hazards of cooptation by synthesizing both systems' elaborate philosophies and knowledges in order to *broaden* health choices; successful integration results from the dialectical procreation of Asclepius and Hygeia. From this perspective, the primary reasons for integration are to benefit HM users and to improve the health system as a whole. As Jonas (2002) notes, if medical ethics are truly attentive to "beneficence, nonmaleficence, autonomy, justice and respect for persons," as is purported, the health care system should respond to the needs of a multiplicity of stakeholders, including those who access HM (132). This sort of balanced integration requires a strategic and systematic implementation that develops consonance between health policies and promotion strategies and the social patterning of beliefs and lifestyles that shape public responses to these official health messages. The Advisory Group on Complementary and Alternative Health Care (2001) proposes that HM and biomedicine should be systematically integrated respecting ten core values: accessibility, accountability, balance, choice, comprehensive outcomes, efficiency, mutual respect, responsibility, universality, and wellness promotion. The parallel between many of these values and the entrenched principles of the Canada Health Act might facilitate integration in Canada. Crellin and Ania (2002) suggest that the Canadian culture of compromise has historically tempered some of the antagonism between HM and biomedical professionals that has occurred elsewhere; this might similarly mitigate the integration process.

Tataryn and Verhoef (2001) point to the Seven Oaks Wellness Centre in Winnipeg, Manitoba, as an example of a large-scale institution that seamlessly provides HM and biomedical services. The Centre's mission is to "promote health, prevent illness and disability, and restore wellness of the body, mind, and spirit" (in Tataryn & Verhoef, 2001: VII.99). While this is one model for integration, it is not clear that one integrative solution could be applied universally with success. Rather, in order to address the broadest patient need, "there may indeed be a movement from the mass provision of care under traditional welfare systems to more individually tailored access to health-care resources" (Armstrong, Armstrong & Coburn, 2001: 5). Integrated program delivery could potentially occur across various settings, and different levels of integration could be phased in for the best fit. Completely seamless integration might be too ambitious in certain settings, where selective integration, partial integration or team care might be more realistic options.[7] Integration is easiest in the rare settings where roles for HM modalities can be clearly identified, where funding providers see reduced costs from incorporating HM, where there are benefits for insurance companies who create or extend HM coverage, where clinical research supports the use of HM, where biomedical practitioners are interested in the possibilities of HM, where legislation and professionalization processes value equally the status of biomedical and HM professionals, and where HM and biomedicine professionals participate respectfully and fully in the dialectical process of improving wellness and quality of life[8] (Coulter, 2004; Tataryn & Verhoef, 2001; Crellin et. al., 1997). Best and Glik (2000) present a model of integrative health services that includes strategies for delivering services that bridge multiple philosophies across the health system, in care delivery models, and in personal health narratives.

The lack of regulation of HM practitioners and the paucity of HM research are two major barriers to integration at the policy and health systems level. As

Casey and Picherack (2001) note, "The fact that a particular modality is regulated serves to "legitimize" the particular health profession to many consumers, governments, organizations, third-party insurers and other health care professionals" (71). In other words, professional status buys the needed credibility for the integration process![9] As governmental decisions about practitioners' scope of practice are still based on a biomedical model, however, the regulation process requires that research satisfactorily demonstrates the value of HM to the powerful biomedical community. Standards for distinguishing safe modalities are particularly vital if the integration of HM leads to publicly-funded access, as an extreme libertarian approach allowing people access to whatever services they want is obviously not feasible. The tremendous recent growth in HM research, as well as the diversity of this research, gives reason to be optimistic that a sufficient evidence base for integration will develop (Jonas, 2002; Furnham & Vincent, 2000 WHO Centre for Health Development, 2000).

The steady reemergence of HM since the 1970s raises the question of "whether alternative practices become mainstream through increased acceptance and usage rather than through the creation of evidence proving their efficacy" (Achilles et. al., 1999: 14). Despite HM's popularity, research in HM lags substantially behind biomedical research. This is due to the lack of funding and training in the researcher-practitioner model that are the sequelae of HM's historical dearth of power. Also, as an implicit strategy to maintain professional boundaries, HM researchers repeatedly identify difficulties in applying biomedical research approaches to holistic modalities (Frohock, 2002; Tataryn & Verhoef, 2001; Patel, 1987). In particular, randomized controlled clinical trials, the gold standard for evidence-based medicine, can be exceedingly problematic to administer in HM research.[10] HM advocates "argue that much of the evaluative research conducted up to now has been tainted by a series of inherent biases," including contextual, taxonomic, outcome and market biases (Achilles et. al., 1999). Recognizing these biased tendencies is a first step in designing balanced scientific research conducive to the integration of HM and biomedicine. Many HM professionals are optimistic about research possibilities, yet they acknowledge that research that is itself *integrative* demands that HM practitioners develop both a better understanding of scientific research (Lewith, 1998) and a thoughtful self-criticism that refocuses the outwardly-focused critical gaze long maintained by these practitioners in order to survive as an alternative culture (Vickers, 1998). Balanced research also requires a more creative and inclusive research agenda that accepts evidence from a wider spectrum of research methods; many researchers suggest possible designs for integrative research (Kane 2004; Callahan, 2002; Lewith, Jonas & Walach, 2001; Glik, 2000; Achilles et. al., 1999; Spencer & Jacobs, 1999). Ultimately, if evidence-based medicine is indeed "the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients" (Tataryn & Verhoef, 2001: 95), broader conceptual frameworks resulting in a greater body of evidence are necessary to evaluate HM *and biomedical* modalities and negotiate how health services could best be integrated.

Successful integration does not necessarily require that HM services are covered by public health insurance, although this certainly would be a major indicator of an integrated system. While the World Health Organization (in Low, 2004) concludes that a key measure of the success of health care systems is their responsiveness to public needs (114), Canadian studies are inconclusive as to whether the population favors coverage of HM in provincial health insurance plans (de Bruyn, 2001; Ramsay et. al., 1999).[11] It is clear that reallocating funds from existing health budgets is a politically touchy proposition, and that the federal government would almost certainly need to present the provinces with conditions for new HM funding (Sullivan & Baranek, 2002: 35). Asymmetrical federalism arrangements like this are most reasonably negotiated with the provinces, as they allow provinces to form plans suited particularly to their populations. This might be especially important with respect to HM, where there is a clear provincial gradient in use as well as in changing HM rates over time, indicating that Canadians in different provinces are being differentially compelled to use HM.

4.3. Limitations

While this study does confirm an intervening role for health status and a confounding role for the broad concept of health-awareness, it also indicates that these factors alone are inadequate to account for the differences in holistic medicine use by individuals with different patterns of physical activity. This lack of explanatory power can be partially explained by limitations in the predictors. Using additional variables for health status in future research would help to flesh out its intervening role, in particular, how acute illnesses and chronic illnesses might be differently affecting the central relationship.

Including additional lifestyle predictors in future research would also improve the crude approximation of the concept of health-awareness that results from using only smoking and alcohol consumption variables. Although smoking habits provide clear evidence in support of the hypotheses, even the alcohol consumption predictor provides ambiguous information. The results showed that those who drink regularly are far more likely to use HM than occasional drinkers and non-drinkers. As excessive drinking is a habit commonly associated with a *lack* of health awareness, this finding could be the natural result of the crude measurement of alcohol use in the NPHS, such that the majority of Canadians are categorized as regular drinkers. No distinctions are drawn between levels of regular drinking that are socially acceptable, and perhaps even considered part of a "healthy lifestyle", and levels that are problematic and indicative of health problems. The wider body of health-aware behaviours and attitudes encompasses much more than these two lifestyle factors, and the omission of a greater diversity of possible NPHS predictors possible is likely problematic for this study. Although the NPHS does question respondents about UV exposure, diabetes awareness, cardiac rehabilitation programs, neighborhood safety and quality, mental health, locus of control and stress of all sorts, many of these questions are in focus sections that do not get asked across cycles, and so are unsuitable for longitudinal analysis.[12] Questions about nutrition and general health knowledge questions that would be helpful in measuring health-awareness are striking omissions in the biomedically-biased NPHS. Perhaps the greatest problem, however, is that a solid concept of "health-awareness" is lacking In general. While many of these NPHS predictors could be loosely hypothesized to be part of the latent concept of health-awareness, future research should explore the statistical and substantive tenability of these connections. Qualitative analysis might be important to illuminate this concept; as Allison (in Henderson & Ainsworth, 2001) notes, "traditional quantitative methods do not always uncover the complex nature of attitudes and practices" (24). Research is also needed to explore both structural and psychosocial barriers that prevent health-aware attitudes from materializing into health-aware behaviours. Quantitative analysis cannot currently control for such barriers because preliminary information is not available.

Another limitation in this study might be the crude measurement of engagement with HM in the NPHS, which does not capture the intensity of HM use. Lifestyle predictors might be more readily able to account for a relationship between physical activity and HM use if subtle differences in length and frequency of HM use were measured. Stigmatization of HM users, remnant from the period of biomedical monopoly, might be leading to underreporting of HM in the NPHS, although this, of course, cannot be known.

4.4. Conclusions and Future Research

The unanswered questions about both the individualization of health and about integrative medicine suggest a need for more comprehensive and indepth research exploring how individuals seek wellness within their social and environmental contexts. It is clear that attempts to artificially isolate health-aware attitudes and behaviours from these larger contexts result in individualistic, reductionistic, and ineffective health promotion strategies. The unexpected result in this study that parental status seriously decreases opportunities for HM use, for example, might suggest that parents have more constrained time or resources to invest in health-aware behaviours and that health promotion strategies that do not take such distal health determinants into account will have little impact. As Kirk and Tinning (1994) note, "exhortions (*sic*) to lead a more healthy lifestyle make little sense in the abstract" (622).

Future research would perhaps benefit from framing the association between health-awareness and HM use in perspectives borrowed from the sociology of the body. This approach would be particularly useful because physical fitness is so embroiled in contemporary discussions of body shape, healthy lifestyles and personal aesthetics. Although the commodified body is the focus of consumption in the fitness movement, understanding how some individuals reject the idealization of particular body types and disengage from their own bodies is central to research about health-awareness (Kirk & Tinning, 1994).

Positioning research in reference to a theoretically present body might help to clarify causality in the relationship between the fitness movement and HM use. Individual growth curve modeling does not allow for causal linkages between predictor and outcome variables, and so it is technically possible that the relationship between physical activity and HM use can be explained by reverse causality. Although the idea that using HM pushes people towards health-aware behaviours like physical activity is perhaps less substantively compelling than this study's models, the possibility should be investigated. Research is also needed to understand how emerging extremism in the beauty culture might be pushing people towards biomedical interventions like plastic surgery, rather than towards holistic options for body and health modifications. As Glassner (1995) points out, "This view of cosmetic surgery [as part of health maintenance] stands a good chance of winning public acceptance over the next several years, given our tendency to confuse beauty with health" (170). Biomedical practitioners might use their public credibility to profit from this confusion by positioning their quick beauty fixes as the natural result of developing health-aware attitudes. This possibility would perhaps impede integrative medicine, and so should be explored. This connection could be analyzed much like in this study, except that engagement in the beauty culture would replace engagement with holistic medicine as the outcome variable.

Research and dialogue about access to holistic medicine as a determinant of health would benefit from a revitalized debate about the role of health services in civil society. The power of the federal government to enhance Canadians' wellbeing has been undermined by market rhetoric that fails to frame health as a fundamental entitlement of citizenship (Armstrong et. al., 2001). Research that continues to call for a greater investment in social and environmental health promotion strategies will be ineffective until governments renew their responsibility to promote the wellness of the population. Analyzing the link between fitness and the reemergence of the holistic medicine movement is only a starting point in thoroughly examining the interconnectivity of health-awareness and health care choices. Given the potential implications of this association as well as a certain epidemiological momentum, research and policy debate in this area is a priority. Health care policies are not necessarily the same as compelling *health* policies; it is time for health care professionals to seriously rethink how to best promote *health* across the heterogeneous Canadian population.

NOTES

[1] Goldner (2004) notes that the idea of individual responsibility,

> Means different things to different people. In the extreme it can mean that 'if you accept responsibility for your health, you have to also accept responsibility for having allowed the disease, creating the disease, or gotten the disease, and that can be something people don't want to do'. Others simply take this to mean that they need to take responsibility for finding the solution, rather than having created the problem. Many consumers feel empowered by this (15).

[2] Neo-liberal governments across Canada have been engaging in programmatic, systematic, and paradigmatic retrenchment of the welfare state in the past two decades. For a description of these types of retrenchment, please see Chapter 5 of Rice and Prince (2000).

[3] Privatization is used here in the sense suggested by Armstrong (1997), as not only "the transfer of responsibility from the public to the private sector, but also from the collectivity to the individual and from the state to the home" (53).

[4] For example, Tones and Green (2004) emphasize a recognition of the broader determinants of health as a critical component of health promotion, and note that "healthy public policy is generally associated with attempts to influence the structural determinants of health" (183). McLeroy et. al. (1988) propose an ecological health promotion model that focuses on how intrapersonal factors, interpersonal processes, institutional factors, community factors and public policy can all support healthy and, by necessity, unhealthy behaviours, and so targets personal, social and environmental factors as part of health promotion strategies.

[5] The mission statement of Health Canada is "to help the people of Canada maintain and improve their health" (Health Canada, 2001; frontispiece). The five principles of the Canada Health Act

are public administration, comprehensiveness, universality, portability and accessibility. See Sullivan and Baranek (2002) for a detailed explanation of these principles.

[6] Willis and White (2004) define politico-legal legitimacy as the,

> Acceptance in the wider society in general and the health system in particular. A healing modality may be said to have politico-legal legitimacy when its occupational territory is legislatively protected by statutory registration, its fees are refunded by various payment organizations including national state-funded health insurance schemes (where they exist), its practitioners are trained within the state-supported higher education system, and so on (58).

[7] Crellin and Ania (2002) describe different integration possibilities, including selective integration, partial integration and team care (60).

[8] Quality of life refers to the "degree to which a person enjoys the important possibilities of his/her life". It is a flexible and dynamic construct that can be used to implement strong integration endeavors as well as to evaluate the outcomes of integrative medicine (Raphael et. al., 1994: 42).

[9] See Saks (2000) for an overview of the politics of professionalization.

[10] Although it is not the aim of this study to comment on the justice of demanding such evidence from HM, it should be noted that such systematic and rigorous testing was not required for biomedical professions to achieve professionalized status and for biomedical modalities to be considered effective and to be publicly funded (Armstrong & Armstrong, 2003; Tataryn & Verhoef, 2001: 96).

[11] Research is needed to determine how public coverage would alter the effectiveness of HM modalities. If part of the reason for this effectiveness is that those paying out-of-pocket for services are more susceptible to placebo effects or more likely to engage in the treatment process, Medicare coverage might not prove beneficial.

[12] These focus sections could be analyzed in cross-sectional research, which could thus be fruitful to further elucidate the relationship between fitness and holistic medicine.

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APPENDICES

APPENDIX A: MET Values Used in the Physical Activity Index

MET values are obtained from the Compendium of Physical Activity (Ainsworth et. al., 2000), following its guideline to code activities as "general" if no intensity ratings are available, as is the case in the NPHS.

Activity	MET Value	Reference Number
Baseball or softball	5.0	15620
Basketball[1]	6.0	15050
Bicycling	8.0	01015
Bowling	3.0	15090
Cross-country skiing[2]	8.0	19090
Downhill skiing	6.0	19160
Exercise class or aerobics	6.5	03015
Fishing	3.0	04001
Gardening or yard work	4.0	08245
Golfing	4.5	15255
Home exercises	3.5	02030
Ice hockey	8.0	15360
Ice skating	7.0	19030
In-line skating or rollerblading[3]	12.5	15591
Jogging or running	(7.0+8.0)/2=7.5	12020/12150
Popular or social dance	4.5	03025
Swimming	6.0	18310
Tennis	7.0	15675
Volleyball	3.0	15720
Walking for exercise	3.8	17200
Weight training	3.0	02130
Yoga or tai-chi[4]	2.5	02100

[1] Added in Cycle 2.
[2] Dropped in Cycle 3.
[3] Added in Cycle 3.
[4] Dropped in Cycle 2.

APPENDIX B: Equations for the Unconditional Model and Model 4

Unconditional Model

Level-1 Model:

$$\eta_{ij} = \pi_{0j} + \pi_{1j}(TIME) + \pi_{2j}(TIME^2)$$

Level-2 Model:

$$\pi_{0j} = \beta_{00} + \mu_{0j}$$
$$\pi_{1j} = \beta_{10} + \mu_{1j}$$
$$\pi_{2j} = \beta_{20}$$

Composite Model:

$$\eta_{ij} = \beta_{00} + \beta_{10}(TIME) + \beta_{20}(TIME^2) + \mu_{0j} + \mu_{1j}(TIME) \qquad \begin{pmatrix}\mu_{0j}\\ \mu_{1j}\end{pmatrix} \sim N\left[\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}\tau_{00} & \tau_{01}\\ \tau_{10} & \tau_{11}\end{pmatrix}\right],$$

where η_{ij} is the log of the odds of using HM; β_{00} is the mean initial status; β_{10} is the mean growth rate; β_{20} is the mean acceleration; μ_{0j} is the random effect of initial status; and μ_{1j} is the random effect of growth rate.

Model 4

Level-1 Model:

$$\eta_{ij} = \pi_{0j} + \pi_{1j}(TIME) + \pi_{2j}(TIME^2) + \pi_{3j}X_3 + \pi_{4j}X_4 + \pi_{5j}X_5 + \pi_{6j}X_6 + \pi_{7j}X_7 + \pi_{8j}X_8,$$

where X_3 is a change in household income; X_4 is a change in energy expenditure from LTPA; X_5 is the number of injuries in the past year; X_6 is a change in activity restriction, X_7 is a change in health utility index score; and X_8 is a change in smoking behaviour.

Level-2 Model:

$$\pi_{0j} = \beta_{00} + \beta_{01}Z_1 + \beta_{02}Z_2 + \beta_{03}Z_3 + \beta_{04}Z_4 + \beta_{05}Z_5 + \beta_{06}Z_6 + \beta_{07}Z_7 + \beta_{08}Z_8 +$$
$$\beta_{09}Z_9 + \beta_{010}Z_{10} + \beta_{011}Z_{11} + \beta_{012}Z_{12} + \beta_{013}Z_{13} + \beta_{014}Z_{14} + \beta_{015}Z_{15} + \beta_{016}Z_{16} +$$
$$\beta_{017}Z_{17} + \beta_{018}Z_{18} + \beta_{019}Z_{19} + \beta_{020}Z_{20} + \beta_{021}Z_{21} + \beta_{022}Z_{22} + \beta_{023}Z_{23} + \beta_{024}Z_{24} +$$
$$\beta_{025}Z_{25} + \mu_{0j}$$

$$\pi_{1j} = \beta_{10} + \beta_{11}Z_1 + \beta_{12}Z_2 + \beta_{13}Z_3 + \beta_{14}Z_4 + \beta_{15}Z_5 + \beta_{16}Z_6 + \beta_{17}Z_7 + \beta_{18}Z_8 + \beta_{19}Z_9 + \beta_{110}Z_{10} + \beta_{111}Z_{11} + \beta_{112}Z_{12} + \beta_{113}Z_{13} + \beta_{114}Z_{14} + \beta_{115}Z_{15} + \beta_{116}Z_{16} + \beta_{117}Z_{17} + \beta_{118}Z_{18} + \beta_{119}Z_{19} + \beta_{120}Z_{20} + \beta_{121}Z_{21} + \beta_{122}Z_{22} + \beta_{123}Z_{23} + \beta_{124}Z_{24} + \beta_{125}Z_{25} + \mu_{1j}$$

$$\pi_{2j} = \beta_{20}$$

$$\pi_{3j} = \beta_{30}$$

$$\pi_{4j} = \beta_{40}$$

$$\pi_{5j} = \beta_{50}$$

$$\pi_{6j} = \beta_{60}$$

$$\pi_{7j} = \beta_{70}$$

$$\pi_{8j} = \beta_{80},$$

where Z_1 to Z_{25} are predictors for being male, cohort, Aboriginal status, immigrant status, having less than a secondary level of schooling, being a secondary graduate, having some postsecondary education, being married, being in a common-law relationship, being divorced or separated, being widowed, having children in the household, living in the Maritimes, living in Quebec, living in Ontario, living in the Prairies, living in an urban setting, household income, energy expenditure due to LTPA, having restricted activity, health utility index, having a regular doctor, smoking cigarettes, being an occasional drinker and being a regular drinker, respectively.

Composite Model:

$$\eta_{ij} = \beta_{00} + \beta_{01}Z_1 + \beta_{02}Z_2 + \beta_{03}Z_3 + \beta_{04}Z_4 + \beta_{05}Z_5 + \beta_{06}Z_6 + \beta_{07}Z_7 + \beta_{08}Z_8 + \beta_{09}Z_9 + \beta_{010}Z_{10} + \beta_{011}Z_{11} + \beta_{012}Z_{12} + \beta_{013}Z_{13} + \beta_{014}Z_{14} + \beta_{015}Z_{15} + \beta_{016}Z_{16} + \beta_{017}Z_{17} + \beta_{018}Z_{18} + \beta_{019}Z_{19} + \beta_{020}Z_{20} + \beta_{021}Z_{21} + \beta_{022}Z_{22} + \beta_{023}Z_{23} + \beta_{024}Z_{24} + \beta_{025}Z_{25} + \beta_{10}(TIME) + \beta_{11}Z_1(TIME) + \beta_{12}Z_2(TIME) + \beta_{13}Z_3(TIME) + \beta_{14}Z_4(TIME) + \beta_{15}Z_5(TIME) + \beta_{16}Z_6(TIME) + \beta_{17}Z_7(TIME) + \beta_{18}Z_8(TIME) + \beta_{19}Z_9(TIME) + \beta_{110}Z_{10}(TIME) + \beta_{111}Z_{11}(TIME) + \beta_{112}Z_{12}(TIME) + \beta_{113}Z_{13}(TIME) + \beta_{114}Z_{14}(TIME) + \beta_{115}Z_{15}(TIME) + \beta_{116}Z_{16}(TIME) + \beta_{117}Z_{17}(TIME) + \beta_{118}Z_{18}(TIME) + \beta_{119}Z_{19}(TIME) + \beta_{120}Z_{20}(TIME) + \beta_{121}Z_{21}(TIME) + \beta_{122}Z_{22}(TIME) + \beta_{123}Z_{23}(TIME) + \beta_{124}Z_{24}(TIME) + \beta_{125}Z_{25}(TIME) + \beta_{20}(TIME^2) + \beta_{30}X_3 + \beta_{40}X_4 + \beta_{50}X_5 + \beta_{60}X_6 + \beta_{70}X_7 + \beta_{80}X_8 + \mu_{0j} + \mu_{1j}(TIME)$$

$$\begin{pmatrix} \mu_{0j} \\ \mu_{1j} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{00} & \tau_{01} \\ \tau_{10} & \tau_{11} \end{pmatrix}\right],$$

where η_{ij} is the log of the odds of using HM; β_{00} is the mean initial status; β_{10} is the mean growth rate; β_{20} is the mean acceleration; μ_{0j} is the random effect of initial status; and μ_{1j} is the random effect of growth rate. β_{01} to β_{025} are coefficients for the grand mean difference in initial status for a one-unit difference in their respective predictors, and β_{11} to β_{125} are coefficients for the grand mean difference in growth rate for a one-unit difference in their respective predictors.