LOCAL ECOLOGICAL KNOWLEDGE AND CHRONIC DISEASE IN THE FORT MCDERMITT PAIUTE-SHOSHONE TRIBE

by

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ABSTRACT

The relationship between chronic disease and traditional knowledge is little understood within indigenous populations of North America. I hypothesize that individuals with higher levels of local ecological knowledge (LEK) will observe lower frequencies of chronic disease and better health outcomes. Health data will be compared to LEK within a subsample (n=31) of individuals residing within the Fort McDermitt Paiute-Shoshone Reservation in Nevada and Oregon. Individual level health data on diabetes mellitus (type 2), pre-diabetes, BMI, chronic heart disease, and hypertension is measured directly by the investigator or self-reported. LEK level data is taken from expert interviews, subject interviews, surveys, and direct observation. LEK data is comprised of species identification, acquisition, and utilization. LEK data regards an individual's level of species knowledge, identification, utilization, acquisition, and preparation of wild floral and faunal species incorporated within the diet and medicinal remedies. The results show that individuals with higher levels of LEK display lower occurrence of the chronic diseases stated previously and their predictors. These results have implications that the promotion of traditional culture within indigenous societies alleviates the negative health effects of chronic disease. It can further be argued that the adaptive strategies associated with LEK provide a prescriptive analog for health behaviors within greater American society.

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LIST OF ABBREVIATIONS

ACA	Affordable Care Act
ADA	American Diabetes Association
AHA	American Heart Association
AI/AN	American Indian and Alaskan Native
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMI	Body Mass Index
CDC	Centers for Disease Prevention and Control
DHHS	Department of Health and Human Services
FDPIR	Federal Distribution Program on Indian Reservations
FMPST	Fort McDermitt Paiute-Shoshone Tribe
FNS	Food and Nutrition Services
IHS	Indian Health Services
LEK	Local Ecological Knowledge
NDWP	Native Diabetes Wellness Program
NIH	National Institutes of Health

NIHB	National Indian Health Board
OMH	Office of Minority Health
SDH	Social Determinants of Health
SPSS	Statistics Package for the Social Sciences
TEK	Traditional Ecological Knowledge
WHO	World Health Organization
USDA	US Department of Agriculture

CHAPTER ONE: INTRODUCTION

The current state of healthcare reform through legislation such as the Affordable Care Act (ACA) has called for a more holistic view of health and healthcare (ACA 2010; WHO 2003). With the quest for this refined health paradigm, it is critical to include evolutionary and ecological insights and models into this new perception of healthcare. There has been little effort on behalf of healthcare researchers and providers to do so to date. The closest model being championed by healthcare researchers and providers that includes any consideration of an environmental or ecological perspective is the Social Determinants of Health (SDH) (Marmot & Wilkinson 2005; Marmot et al. 2008). Unfortunately, the SDH and other models that attempt to explain the rising prevalence of chronic disease focus primarily upon socio-economic factors that affect an individual's state of health (Glanz et al. 2001; Marmot & Wilkinson 2005; Marmot et al. 2008; WHO 2003). There is little mention of the environmental factors that affect health. Instead the current models being championed by health researchers and professionals only acknowledge the effects of the social environment upon an individual's health status (Glanz et al. 2006; Marmot & Wilkinson 2005; Marmot et al. 2008). This is especially troubling for indigenous populations residing on federally established reservations. Where the economic and geographic isolation of these populations has led to a common them in socio-economic factors experienced within these populations (Young 1994). The existence of traditional cultural knowledge and practices within these populations and differing levels of the adoption and utilization of such traditions could be utilized in explaining the differences in individual health status more efficiently than the current models such as the SDH. Thus, this investigation focuses on how traditional knowledge and practices are affecting the health outcomes of an indigenous population within the US.

Is there a relationship between chronic disease and local ecological knowledge (LEK) existing within an indigenous North American population living in a federally established Indian Reservation? How does an individual's level of LEK affect their health? Can traditional culture or knowledge be an adaptive response for reducing the negative health effects of chronic disease? Ecological knowledge and engagement are important factors upon an individual's nutrition, behavior, and health (Berkes & Jolly 2002; Young 1994). This research explores these questions with behavioral and health data gathered from the Fort McDermitt Paiute-Shoshone Tribe (FMPST) in Nevada and Oregon, who utilize traditional, market integrated, and federally subsidized subsistence patterns and medical services. To date, no such research exists. The creation of a model that takes into account the effects of traditional knowledge and practices is especially relevant to the study of chronic disease, as well as the creation of health promotion programs within indigenous populations that also promote traditional culture.

There is evidence suggesting that the high prevalence of chronic disease in indigenous populations is linked to the decline of traditional cultural practices (Young & Bjerregaard 2008; Young 1994). Meanwhile, the world's cultural (Reyes-Garcia at al. 2013), biological (Sutherland 2003; Thomas et al. 2004), and linguistic (Harmon & Loh 2010) variation is constantly declining, leading to a loss in variation and range of behavioral responses to negative health influences. Understanding the relationship between LEK and chronic disease will be foundational and fundamental in promoting traditional culture and improving the health of individuals. Providing a means of measuring this decline, and the relationship between culture-change and behavior, which can be computed into monetary value, creates a beneficial outcome for traditional cultural practices in indigenous societies and budgetary reductions for policy makers.

CHAPTER TWO: BACKGROUND

Of the many challenges facing Native people in the United States, health issues related to food and nutrition are the most pervasive and overwhelming (Young 1994; Young & Bjerregaard 2008). Even in a sparse environment such as the Great Basin nutrition-related chronic diseases were rarely, if ever a problem for the ancestors of individuals holding tribal status living on and off Indian reservations. Why then are these populations now observing health problems and maladies related to nutrition and activity? Recent alterations to individuals' ability to directly interact with their environment, ecology, and resources may be the cause. The separation of indigenous populations from their environment and traditional economy has not been a choice that was made by tribal peoples or their leaders. These choices were imposed upon Native peoples both historically by colonial agencies and presently by federal agencies through policies openly forcing the systematic removal of tribal peoples from their traditional lands. One response to health and nutritional threats is the revival of traditional knowledge and practice regarding diet and environmental engagement.

Substantial health problems are prevalent among Native American populations for many conditions, including heart disease, tuberculosis, sexually transmitted diseases, and injuries. The prevalence of diabetes is higher among the American Indian and Alaskan Native (AI/AN) population (17.5%) than any other major racial or ethnic group in the United States, and the prevalence of diabetes has been increasing (CDC 2010).

Comparatively non-hispanic whites have a frequency of 6.6% of persons over 18 with diabetes type 2 (CDC 2010). Additionally, the AI/AN population experiences a frequency of 7.2% of persons over 18 being diagnosed by a health professional with coronary heart disease (age-adjusted), as compared with a frequency of 6.1% of non-hispanic whites (CDC 2010). The AI/AN racial category also has the highest infant mortality rate (8.5%) of any other racial category used by the US census bureau (Acton etl al. 2002). Roughly 35% of Native American adults experience hypertension as compared to the frequency of their Euro-American counterparts with 25% (CDC 2010). However, many health problems such as these are under-reported in North American indigenous populations (Young 1994; Acton et al. 2002). Health disparities may be related to cultural, genetic, socioeconomic, and behavioral factors as well as access to and utilization of health care (CDC 2010).

Diabetes impacts native people in the United States in unprecedented rates. With a frequency much higher than national averages occurring in adults over the age of 18, Native Americans are experiencing a diabetes epidemic. Diabetes is a group of metabolic diseases characterized by high blood sugar or hyperglycemia (American Diabetes Association [ADA] 2004). The ADA defines diabetes as a random glucose level greater or equal to 200 mg/dl or a fasting plasma glucose greater than or equal to 100 mg/dl or a 2-hour glucose tolerance test with a plasma glucose greater than or equal to 200 mg/dl (ADA 2004). Type 2 diabetes, adult diabetes, or non-insulin-dependent diabetes frequently occurs within adults who are considered obese (CDC 2015). This disease has been increasing in frequency among youth and adolescents considered to be overweight or obese (CDC 2014).

There is evidence suggesting that the frequencies of chronic disease currently observed within indigenous populations is directly linked to the decline of traditional practices (Young 1994; Young & Bjerregaard 2008). Understanding the relationship between LEK and chronic disease will be foundational in promoting traditional culture and improving the health of individuals. Providing a means of measuring this decline, and the relationship between culture-change and behavior, which can then be computed into monetary value, creates a beneficial outcome for indigenous societies, through the promotion of traditional practices existing within indigenous cultures and budgetary reductions for policy makers such as those at the Department of Interior, Bureau of Indian Affairs (BIA), Department of Health and Human Services (DHHS), and Indian Health Services (IHS).

Ecological knowledge has been shown to buffer against the negative effects of poor nutrition upon health in indigenous populations (Young 1994). Existing literature suggests LEK produces multiple positive returns to individuals in indigenous societies (Mcdade et al., 2007; Reyes-Garcia et al. 2008). For example, other researchers found that LEK assists in the ability to deal with pest infestation (Bentley and Rodriguez 2001), cope with weather shocks (Kuhnlein and Turner 1991), adapt to changing climate (Berkes and Jolly 2002), select cultivars (Perales et al. 2005), manage natural resources (Berkes 1999; Medin and Atran 1999; Olsson and Folke 2001), and enhance health and nutritional status (Etkin 2000; Johns 1996; McDade et al. 2007). If this is indeed the case, establishing a link between LEK and health is important for both public health and maintaining cultural diversity.

LEK has multiple definitions depending on the researcher and the questions they may be asking. Thus, LEK appears ambiguous, with no universally accepted definition (Berkes 2008). It is a derivation of Traditional Ecological Knowledge (TEK), which emerged from a combination within the fields of study found in ethnoscience and human ecology (Berkes 2008). LEK is defined as a cumulative body of knowledge, practice, and belief, evolving through adaptive processes and handed down intergenerationally via cultural transmission, of the relationships between living beings with one another and their physical environment (Berkes 1993; Gadgil et al. 1993; Berkes et al. 1995; Berkes 2008). LEK generally references bodies of knowledge found non-industrial societies which have aided in these societies ability to successfully adapt to and exploit their environments, but is not specific to this type of population (Berkes 1993; Gadgil et al. 1993; Berkes et al. 1995; Berkes 2008). The term local is substituted for traditional in this case, because it is less problematic and refers to the specific ecological contexts in which a population exists. Measurement of LEK within individuals can be used as proxy for diet, nutrition, and behavior as it requires the combination of theoretical and practical knowledge (Berkes 2008; Reyes-Garcia et al. 2010; Reyes-Garcia et al. 2013). LEK data in this research is related to edible and medicinal wild species incorporated within an individual's diet or healthcare system. LEK is rooted in both theoretical and practical knowledge that involve direct interaction with the landscape and its living and non-living entities (Berkes 2008). This research provides both an investigation of the effects of LEK upon health in North American indigenous populations and a prescriptive analog for behaviors involving the interaction with local ecologies and resources that promote health optimization both in indigenous societies and greater North American society.

Study Site

The Paiute-Shoshone are of special interest due to high frequencies of chronic diseases experienced by the population that have allowed them to be described as high risk (Brookes et al. 2013). The Fort McDermitt Paiute-Shoshone Tribe (FMPST) near McDermitt, Nevada is a recognized tribe and Indian reservation by the US Bureau of Indian Affairs and Department of Interior. It consists of a small community with approximately 1500 members, of which roughly 375 live within reservation boundaries. Tribal members consist of mixed Paiute and Shoshone descendants as well as a small number of individuals from other tribes, namely Navajo and Sioux. This community is both economically and geographically isolated with no form of tribal enterprise such as gambling, which is common to some reservation communities nearby such as the Shoshone-Paiute Tribe of Duck Valley in Idaho and Nevada, the sister tribe of the FMPST. Individuals residing within the community also experience restricted local access to markets. There exists a small grocery store and a gas station within the town of McDermitt (neither of which are tribally affiliated), otherwise the nearest grocery stores (Wal-Mart and Raley's) are 70 miles away in Winnemucca, Nevada. The costs of resources are markedly increased as a result of this isolation (Table 1).

Table 1: Comparisons of the Cost of Staple Foods

Grocer	80/20 ground beef	gal 2% milk	doz AA large eggs	gal orange juice	onion/lb	potato/lb	tillamook md cheddar	loaf wht bread	5# all purpose flour
Ideal Market, McDermitt, NV	3.49	4.29	2.89	5.19	0.69	0.59	12.99	1.99	2.69
Wal-Mart, Winnemucca, NV	3.48	2.98	1.98	3.98	0.5	0.45	8.98	1.18	1.88
Raleys, Winnemucca, NV	3.99	3.99	1.98	3.98	0.79	0.69	8.99	1.45	2.28

All prices are in US dollars and were recorded on May 11 and 12, 2014

During and after the hunting seasons, individuals with ties to those residing within the reservation will bring portions of their kills to kin and friends living within the reservation, as well as the hides and carcasses for processing and distribution of meat. This practice has its roots in food-sharing, kinship, and reciprocity. Furthermore, the exchange of resources is not unidirectional. Many individuals living within the reservation will gather wild resources like sage, chokecherry, pine nuts, and tubers while distributing them to kin and friends residing outside of the reservation. This practice is especially commonplace with regard to the harvesting of pine nuts, of which portions are sent outside of the reservation to family and friends. These behaviors and the nutrition they provide are markedly different from the Federal Distribution Program on Indian Reservations (FDPIR), which is administered by the Food and Nutrition Service (FNS), a department of the US Department of Agriculture (USDA). The FDPIR distributes monthly allotments of calorically dense and nutritionally void commodity foods to the study population (Office of Minority Health [OMH] 2010; USDA 2014). Furthermore, the FDPIR has been modeled after the military-mess or cafeteria model, which both historically and contemporarily provide high-calorie, low-cost, low-bulk, and long shelf life foods to US servicemen and women (USDA 2014). Contemporarily, the FDPIR is considered an alternative program to the FNS' Supplemental Nutrition Assistance Program (SNAP), formerly known as food stamps (OMH 2010; USDA 2014). In order to receive FDPIR allotments one must qualify under the economic and demographic requirements of SNAP (USDA 2014.) Unfortunately an overwhelming majority of registered tribal members within the United State meet these requirements (Acton et al. 2002). Generally FMPST tribal members feel that the FDPIR distributions are devoid of flavor and nutrition while having high quantities of sugars and processed carbohydrates (USDA 2014). If given the choice they would much prefer to utilize wild foods and more healthy food options than rely upon the FDPIR.

A major issue is the geographic and economic isolation of the tribe. One way in which this is instituted by federal agencies is the removal of tribal peoples from reservation lands by the Bureau of Land Management on the Oregon side of the border. The Department of Interior issued a memorandum to the tribe in 1997 accusing the tribal government of mismanaging a major portion of tribal land on the Oregon side of the reservation. In order to manage these lands properly, the stewardship of these properties was to be temporarily relegated to the BLM. The BLM was to remain in control of this property until the FMPST could provide the properly trained personnel along with a management plan to do so. Although multiple plans are reported to have been submitted in the last 18 years, the land remains under BLM management. This property was also reported to be some of the best areas to acquire many important resources such as deer, antelope, marmot, chokecherry, and pine nuts. All of which are traditionally of great importance to the people of the FMPST. Furthermore, the McDermitt Creek, which is the main body of water supplying the reservations irrigation and drinking water, has been mismanaged and contaminated over the last forty years. In the late seventies, a reservoir was created when the FMPST contracted the erection of a dam in order to provide a reliable water supply for the irrigation of agricultural fields on the reservation. According to tribal officials this was constructed improperly and water only flowed for about a decade, after which it was discovered that the dam was collapsing and water was being diverted away from McDermitt Creek toward the Oregon border. Since this time there are annual cholera outbreaks and fishing is only possible during a few month of the year when precipitation and snowmelt is high.

Previous Explanations and Hypotheses

Of the many problematic issues facing Native people in the United States, health issues related to food and nutrition are the most pervasive and overwhelming (OMH 2010). These same issues were never a problem for the ancestors of individuals holding tribal status living on and off Indian reservations, including Native Americans, Mexican Indians, and the First Nations people of Canada (Young 1994; Young & Bjerregaard 2008). This begs the question of what has occurred within these populations that are now observing health problems and issues. One of the answers and the most significant is the recent alteration to an individual's ability to directly interact with their environment, ecology, and resources (Berkes 2008; Ingold 2000; Louv 2005). The separation of indigenous populations from their environment and traditional economy has not been a choice that was made by tribal peoples or their leaders. These choices instead, were imposed upon Native peoples both historically by colonial agencies and presently by federal agencies through policies openly forcing the systematic removal of tribal peoples from their traditional lands (Steward 1955). Many of the health and nutritional issues indigenous peoples are presently experiencing are directly analogous to the greatest health issues faced within greater North American society. Previous attempts to explain the increasing health and nutritional threats to at-risk populations such as indigenous Americans are based upon socio-economic status such as the social determinants of health (Marmot et al. 2008; Marmot & Wilkinson 2005), the epidemiologic transition (Omran 1977), maladaptive diet (Eaton et al. 1988; Eaton et al. 1996), and life history theory (Bogin 1999; Drake & Walker 2004).

Diet and Nutrition

Based upon the work of Leslie Lieberman, S. Boyd Eaton, and Merle Konnor there are a multiplicity of contributing factors to the diabetes and obesity problem(s) within Native American populations, but essentially the problem can be distilled as a recent shift away from the foraging conditions in which humans evolved (Eaton et al. 1996; Eaton et al. 1988). The hallmarks of global dietary modernization are increased energy intake with processed calorie-dense foods, increased quantity, and increased ingestion frequency. These dietary changes are then coupled with behaviors that significantly reduce individual levels of energy expenditure (Lieberman 2003).

As for macro- and micro-nutrient intake within the modern diet, food producers and marketers are capitalizing upon our evolved genotype, in which it would have been favorable within the context of a foraging life way to develop a preference for calorie and nutrient-dense resources that also happen to be scarce, such as the old holy trinity of fats, sugars, and salt. Food processing technologies are used to produce foods that have desirable characteristics, including sweet taste and crunchy textures, in addition to foods with high energy and nutrient density and low bulk, facilitating increased consumption (Spurlock & Gabler 2008). Eaton and his colleagues (1999) note that there is very little in common between Paleolithic diets composed primarily of wild plant and animal foods and contemporary diets (Eaton et al. 1996). Furthermore, these prehistoric diets would have regionally adapted to the locally available food resources. Perhaps most significant in regard to diabetes and obesity is the flip-flop that took place between fiber and fat intakes. Because the diet of our Paleolithic ancestors was composed primarily of a foraging strategy, they would have relied heavily upon a large assortment of wild plant foods that would have varied seasonably and geographically. Even with this variability within context, the amount of fiber intakes within the Paleolithic diet would have been magnitudes greater than the FDA recommendations of today. This increased fiber intake is then coupled with the scarcity of availability of natural sources of calorie-dense fats. In fact, the major sources of fat would have come from wild game and fat or oil dense fruits, both of which would have been scarce in comparison to the fiber rich plants making up the majority of food resources. In contrast, for most contemporary populations, macro-nutrients and calories are from processed grains, fatty domesticated animals, high-fat dairy products, and refined sugars (Liebermann 2006). Contemporary global diets are "fat rich and fiber poor" (Drewnowski and Popkin 1997).

Life History Theory, Fetal Programming, and the Intergenerational Effect Hypothesis

Unfortunately neither evolutionary nor life history theory are taken into consideration when developing disease prevention and health promotion programs for indigenous North Americans (National Indian Health Board [NIHB] 1998). Fortunately, there have been recent attempts to include traditional indigenous knowledge within such programs being administered by Indian Health Services (IHS) (NIHB 1998; OMH 2010; NDWP 2015). To date, all of these programs have been initiated by the tribes themselves (NIHB 1998; NDWP 2015). However, the Department of Interior, Bureau of Indian Affairs, and The Department of Health and Human Safety should take note of these recent programs. Resulting from the use of traditional knowledge and practices being utilized within these pioneering programs, traditional responses to disease contain evolutionarily adaptive strategies (Young 1994). Therefore, life history theory is inherently embedded within culturally evolved practices (Young and Bjerregaard 2008).

The fetal programming hypothesis suggests that environmental stimulus experienced in utero acting upon critical periods of development and growth may permanently alter tissue structure and function, which affects phenotypic responses (Drake and Walker 2004). Furthermore, the effects of fetal programming have direct implications upon an individual's ability to survive and reproduce. Fetal programming, often measured in low birth weight offspring, directly affects an individual's future ontogeny (life history stages), maturation, reproduction, and immunity (Bogin 1999). Low birth weight has a well-established correlation with chronic diseases later in life including cardiovascular diseases and metabolic disorders (Drake & Walker 2004). This may in fact be an adaptive phenotypic response to in utero environmental stressors, which program an individual's tissues in expectation of future stressors in order to survive to reproduction (Drake & Walker 2004). Gestation and infancy are important life history stage that directly affect an individual's fitness later in life and are perhaps the most critical phases of ontogeny.

The Epidemiologic and Demographic Transition

The epidemiologic transition occurs as populations undergo the process of modernization from developing to developed status and is deeply rooted in the demographic transition. The epidemiologic transition involves a characteristic shift in the diseases pattern of a population as mortality rates decline within the demographic transition (Omran 1977). While acute, infectious diseases are reduced as a result of technological innovations in health and medicine, chronic, degenerative diseases increase in prevalence within a population as a result of changing diet and behavioral patterns related to market economies, causing a gradual shift in the age pattern of mortality from younger to older ages (Omran 1977). The phenomena associated with the demographic and epidemiologic transition are often related to economic or cultural success.

Reproductive strategies are directly correlated with economies. There exists a well-established correlation between reproductive success and cultural and or economic success (Mace 2000). Because fitness is directly related to reproductive success, it makes evolutionary sense that increases in economic success impact both survival and reproduction within the confines of competition for available resources. Individuals make reproductive choices based upon the availability of resources. More resources increase the ability to provide for reproduction and offspring as well as reduce mortality. Generally, this relationship leads to individuals with more access to resources producing larger families (Newsom et al. 2005).

However, the phenomena associated with the demographic transition have changed the paradigm. Within developed and developing nations, the demographic transition has altered the tradeoffs constraining reproduction. The resulting increase in the costs of offspring associated with the increase of available resources has caused an inverse relationship between wealth (success) and reproduction to be observed. This pattern reveals that as wealth increases the number of offspring decreases within populations undergoing the demographic transition where wealth is inherited intergenerationally. This phenomena has been linked to a quantity quality tradeoff between choosing a small number of high quality offspring able to successfully compete within developed nations or a large number of low quality offspring with lower chances of competitive success. Within this context, there is also the phenomenon of increased kin dispersal within a population having undergone or undergoing the demographic transition. This could cause the signals from kin that promote high reproductive success to diminish while non-kin influences that may promote other behaviors to increase, as well as a decrease in support networks and alloparenting. Within these confines and contexts parents are in fact making adaptive choices in regard to the reduction of family size based on the increased cost of raising successful offspring (Mace 2000). Perhaps the most significant increase in the cost of raising children within the demographic transition is to available time (Newsom et al. 2005). As societies undergo the demographic transition, the amount of time required of individuals to be able to successfully compete for available resources substantially increases (Galor & Weil 2000). This essentially leaves parents with less ability to successfully raise large quantities of costly offspring. However, the majority of Native American individuals are unable to compensate for the increased costs of raising highly competitive offspring, as they are of low socio-economic status and have restricted access to healthcare (Young 1994). This could lead to a possible explanation as to the high frequencies of chronic disease experienced by these populations. Wherein the costs of raising offspring are ever increasing, these populations seem to be becoming more and more socially and economically marginalized over time, resulting in poor nutrition for mothers and their children.

The Social Determinants of Health

The Social Determinants of Health is the new model championed by the World Health Organization (WHO), the National Health Service (NHS) in Britain, and the Healthy People 2020 program initiated by the Office of Disease Prevention and Health Promotion (ODP) which is a bureau of the National Institute for Health (NIH) (Marmot & Wilkinson 2005; Marmot et al. 2008; HealthyPeople 2015; NIH 2015; DHHS 2012; WHO 2003). This model attempts to operationalize a holistic perspective of health that takes into account all the variables that affect an individual's state of health and well-being (Marmot & Wilkinson 2005, Marmot et al. 2008). The SDH utilizes socio-economic variables such as demographics to understand all the contributing factors affecting the health outcomes at a population level (Marmot & Wilkinson 2005). The variables used by the SDH to understand the factors affecting an individual's health include the economic stability, education, social and community context, health and healthcare, and the neighborhood and built environment (Marmot et al. 2008; HealthyPeople 2015; DHHS 2012). The promoters of this model conclude that all these variables are interconnected and serve as the greatest contributors to the health and well-being of an individual (Marmot & Wilkinson 2005; Marmot et al. 2008; DHHS 2012; HealthyPeople 2015).

Though the SDH is the new model being utilized in disease prevention and health promotion there has been little to none research to date that measures the effects of the

SDH upon the health outcomes and health predictors associated with chronic disease. Instead there is a piecemeal conglomeration of previous studies via meta-analysis used to posit the effects of the SDH upon various health maladies and diseases such as smoking and drinking (Marmot & Wilkinson 2005). Additionally, there is no accounting for the effects of the physical environment and the local ecology upon an individual's current state of health, much less how an individual's knowledge of their environment affects their behavior and decisions regarding diet and nutrition. This is especially relevant for understanding the health status of indigenous peoples and other at-risk populations who have long-standing traditions regarding the interactions between humans and their environment.

Thus, this research utilizes variables that are congruent with the SDH alongside variables that measure an individual's knowledge of their environment and its resources. This allows for a greater depth and breadth for investigating all the contributing factors to the health of indigenous peoples here in North America. If in fact a person's knowledge of their local ecology plays as significant if not greater role in their health, then factors such as LEK should be incorporated into current disease prevention and health promotion models such as the SDH.

How Previous Explanations Inform This Study

As previous research has focused upon the evolutionary, epidemiologic, epigenetic, life history, and demographic factors that affect chronic disease outcomes and predictors, this study focuses on the behavioral choices made in response to ecological knowledge. Little effort has been done to understand the environmental and ecological factors. Thus, this investigation focuses upon these very factors by operationalizing and utilizing the variable LEK. Within a rural indigenous population considered to be at-risk, an individual's knowledge of their environment and its resources is just as likely to contribute to their current health status regarding diabetes type 2, obesity, hypertension, and chronic heart disease.

Hypotheses Tested

H1: As LEK increases within individuals, a negative correlation with diastolic and systolic blood pressure will be observed.

H2: As the amounts of locally available foraged foods incorporated within the diet increase, metabolic disorders such as diabetes mellitus, prediabetes, and obesity will decrease.

H3: Individuals with low levels of LEK will be experiencing more than one or all of the following health problems: obesity, elevated systolic and/or diastolic blood pressure (pre-hypertension/hypertension), diabetes mellitus (Type 2), and chronic heart disease.

H4: As LEK increases within individuals, a negative correlation with BMI will be observed.

CHAPTER THREE: METHODS

Sample Design and Strategy

The sample includes 31 individuals drawn from a stratified, random sample of individuals reported living on the FMSPT in tribal census data. SPSS was used to generate a random sample stratified by age and gender. The age range included all individuals over the age of 18 residing within FMPST reservation boundaries based upon demographic data taken directly from tribal census records recorded in 2010. Gender was also stratified using statistical reports from the 2010 tribal census reports.

Data Collection

Data was collected over 34 days in the months of June, July, and August 2014. All data was collected personally by the investigator and comes from tribal records, reports, and administered interviews with study participants.

Health Measures

Direct measures of health will be obtained through BMI, diastolic blood pressure, and pulse. BMI was measured using a scale to obtain a measure of an individual's weight; a tape measure is used in order to measure individual height and also the circumference of the waist. BMI is then calculated with a formula obtained through the Centers for Disease Control (CDC 2014) and their BMI interpretation tables. Diastolic blood pressure, systolic blood pressure, and pulse were measured using an Omran Series 5 Advanced Blood Pressure Monitor. Interpretation of diastolic and systolic blood pressure will be based upon CDC guidelines and American Heart Association (AHA) interpretation tables (CDC 2014; AHA 2015). Additionally all respondents were asked to report as to whether they have been previously diagnosed with the following chronic diseases: Pre-diabetes, Heart Disease, and Diabetes Mellitus type II.

BMI = weight (kg) / [height (cm)] ^2

LEK and Health Interviews

Self-administered mixed-method surveys were gathered from informants in the study sample. The primary methods for measuring LEK within the sample population derive from the free-listing of local flora and faunal species generated by informants. The initial free-lists were based upon the identification of floral and faunal species utilized in the diet and traditional remedies for illness and/or injury. Follow up questions were designed to gauge the informants level of knowledge on the acquisition, utilization, and preparation of the species previously identified in their lists. These include such questions as to location, seasonality, methods of preparation, and the frequency of utilization. Secondly, an additional set of survey questions were based upon the informant's knowledge of a species multiple uses or utility. These consist of the identification of common knowledge specie's identified previously in earlier interview questions and listed by the respondents to assess their knowledge of identifying these common species along with their acquisition, preparation, and utilization. A third set of survey questions compiled demographic data on informants such as education, income, household size, and how long they have resided within reservation boundaries. Lastly, a set of survey questions were designed to measure the informant's level of enthusiasm for LEK. These final questions gauge whether they would like to learn more about LEK, where to obtain such knowledge, and the level of social influence in either encouraging and/or discouraging LEK. These survey methods generate multiple levels of data on LEK for later statistical analysis.

LEK Scale

An LEK scale was designed using variables related to wild edible or medicinal species identification, acquisition, preparation, and utilization. These variables include the number of wild edible and/or medicinal species an individual could list, where and when species could be acquired, the methods of preparation for their top listed species, the last time they ate a wild species or used them as a traditional remedy, and whether or not they preferred wild foods and remedies over those available through local markets or health-care providers. The range of species listed (5-29) was computed into a scale from 0-10 by dividing their score in half. Preparation was also scaled using the range 1-6 allowing for scores of 0-5. Acquisition was scaled using the median answers for locale and season of the specific species they listed first, where a scaled score was assigned from 0-1 for both seasonality and location variables based on whether their answers fell within the median. Utilization was scaled using the median answer again of two weeks or 14 days, if an individual had eaten a wild species within this time frame they received a 1, if not a 0. The same procedure was used for traditional remedies, but with a longer time period of one month or 30 days. Lastly, if a person preferred eating wild foods and traditional remedies to those available through market economies they received a score of 1, if not 0. This gives an overall LEK scale ranging from 0-20.

Statistical Analysis

Statistical analysis was performed using Microsoft Excel, Access, and the Statistics Package for Social Sciences (SPSS) from IBM (Microsoft 2010; IBM Corp. 2011). The analytical tests utilized in this research include descriptive statistics, frequencies, correlations, and linear and logistic regression modeling of variables pertaining to demographics, health measures, previous diagnoses, and the LEK scale.

CHAPTER FOUR: RESULTS

Demography

The age distribution of the sample ranges 19-72 with a mean age of 38.5, a mode of 21, and a standard deviation of 14.82 (N=31). The gender distribution of the sample population is 57% female and 43% male. On average, each study participant has 4.2 individuals residing within the household with a mean of 2.4 generations. The unemployment rate of the study sample is 40%. On average, the study participants have attended 12.17 years of school with a standard deviation of .592. Thus, the average family residing within FMPST reservation boundaries consists of 2 adults age 21-39 with at least one child and one parent (most likely a mother) residing with them in the household. Both parents have high school diplomas and are currently employed. There is also a high likelihood that the grandparents under the age of 62 are currently employed.

Health

Study participants experience a mean body mass index (BMI) of 29.6 with a standard deviation of 5.36 and a mode of 32 (N=31). The diagnoses of the sample population based upon BMI turns out that 0% of the population over the age of 18 is underweight with BMIs under 18.5, 23.3% of the population falls within the normal BMI range of 18.5-24.9, 26.7% of the population is within the overweight range of 25-29.9, and 50% of the population is obese with BMIs over 30. Comparatively, the national prevalence for obesity is 34.9% of adults in the American population having been diagnosed (Ogden et al. 2014). Additionally, 27% of the sample has been previously diagnosed as being prediabetic. 17% of the population has been previously diagnosed with diabetes type II, and 3% of the population has been previously diagnosed with ischemic heart disease. The national prevalence of diabetes type 2 is currently 9% of the American population (CDC 2015) The average systolic blood pressure of the sample is 127.5 (N=26, SD 17.8). The average diastolic blood pressure of the sample is 80.19 (N=26, SD 10.2) and the average resting heart rate is 73 beats per minute (N=26, SD 17.4). Furthermore, according to American Heart Association (AHA) guidelines on interpreting blood pressure, systolic blood pressure for 36% of the sample is within normal ranges, 52% are classified as pre-hypertensive, and 12% are experiencing dangerous levels of hypertension (beyond the hypertensive range) (AHA 2015). According to diastolic blood pressure 53.8% of the sample population falls within normal ranges, 19.2% are experiencing pre-hypertension, and 26.9% experience hypertension. Comparatively, 29.1% of American adults over the age of 18 experience hypertension (Nwankwo et al. 2013)

Local Ecological Knowledge

The average amount of wild species that are edible or can be used in medicinal remedies listed by participants was 14 with a standard deviation of 6.14 (N=31). The median number of species listed was 15. The mode was 19 species listed. Two individuals within the sample received LEK scale scores of 1 and one individual received a score of 0. These three outliers are responsible for the negative skew of the mean as compared to the median and mode. All three of these individuals were also young, ages 19–21, where their age and education are most likely responsible for their low levels of

LEK (Demps et al. 2015). A free-list analysis indicates that three species are listed 100% of the time by participants and are listed by rank order: deer, antelope, and sage. The ten species most frequently listed in rank order are: Mule deer 1.0, antelope 1.0, sage 1.0 (medicinal), groundhog 0.97, rabbit 0.93, chokecherry 0.87, brown trout 0.71, squirrel 0.61, wild potato 0.52, and rainbow trout 0.45.

Checking Assumptions

A Kolmogorov-Smirnov (KS) test was run to check the assumption of normality on the variables that are predictors of chronic disease, previous diagnoses of chronic disease, and LEK. This test indicated that all variables excluding BMI, systolic blood pressure, and LEK had violated the assumption of normality. A Levene's test was also run to check the assumption of homogeneity of the variance. No variables violated this assumption. Thus, Pearson's correlations were run to compare LEK with BMI and systolic blood pressure. While Spearman's Rho correlations were run to test the effects of LEK upon systolic blood pressure and previous diagnoses of pre-diabetes, diabetes type 2, and chronic heart disease. Spearman's Rho correlations were also used to test the effects of demographic variables such as age, gender, education, and employment upon BMI, systolic and diastolic blood pressure, and previous diagnoses of the chronic diseases in this study.

Demographic**s and Health**

The only significant effect that age has is upon systolic blood pressure ($r=.407$, $p<.05$, $N=26$) (Table 2). Gender is also only significant in its effect upon systolic blood pressure ($r=.253$, $p<.05$, $N=26$) (Table 3). An individual's level of education or whether they are employed had no significant effect upon chronic disease predictors or diagnoses. A logistic regression analysis was performed to measure the effects of variables consistent with the SDH, including education, employment, number of individuals residing within the household, and the number of generations within the home upon prediabetes, diabetes, cardiovascular heart disease, and a combined variable of these diagnoses. Unfortunately, these analyses did not yield any significant results.

Table 2: Effects of Age upon Health

		Age	BMI	Systolic	Diastolic	Pulse	PD	DB2	HD
Age	Correlation	1	-0.053	**0.407***	0.035	-0.012	0.078	0.243	0.247
	Sig. (2-tailed)	.	0.782	0.039	0.866	0.952	0.681	0.196	0.189

*significant at 0.05 level

Table 3: Effects of Gender upon Health Measures

		Gender	BMI	Systolic	Diastolic	Pulse	PD	DB2	HD
Gender	Correlation	1	0.253	**0.436***	0.265	0.068	0.233	0.15	0.212
	Sig. (2-tailed)	.	0.177	0.026	0.19	0.743	0.215	0.428	0.26

*significant at 0.05 level

LEK and Health

An individual's level of LEK has a significant effect upon BMI ($r = -.591$, $p<.01$, $N=31$) (Table 4). Also BMI and systolic blood pressure are correlated ($r = .418$, $p<.05$, $N=26$) (Table 4). LEK has no significant effect upon participants resting heart rate (pulse) or previous diagnoses of prediabetes, diabetes type 2, or heart disease.

Table 4: Effects of LEK upon Systolic Blood Pressure and BMI

		LEK	Systolic BP	Diastolic BP	BMI
LEK	Correlation Coefficient	1	0.002	**-.449***	**-.591****
	Sig. (2-tailed)	.	0.992	.021	0.001
Systolic BP	Correlation Coefficient	0.002	1	**.552****	**.418***
	Sig. (2-tailed)	0.992	.	.003	0.034
Diastolic BP	Correlation Coefficient	**-.449***	**.552****	1	**.839****
	Sig. (2-tail;ed)			-	.000
BMI	Correlation Coefficient	**-.591****	**.418***	**.839****	1
	Sig. (2-tailed)	0.001	0.034	.000	.

*significant at 0.05 level, **significant at 0.01 level

Linear regression models were run on BMI and diastolic blood pressure as the dependent variables and LEK as the independent variable. One such model displays that LEK has a significant effect upon BMI ($p < .05$), $R = .550$ and can explain 30.3% of the variation in BMI (Figure 1). Accordingly, LEK has a significant effect upon diastolic blood pressure ($p < .05$), but can only explain 11% of the variation in blood pressure. Therefore a multiple regression model was run including age, gender, and employment as independent variables alongside LEK. This full model explained the greatest amount of variance. In this model, the predictor variables previously stated had an effect upon BMI ($R = .612$) and can explain 37.4% of the variation in BMI.

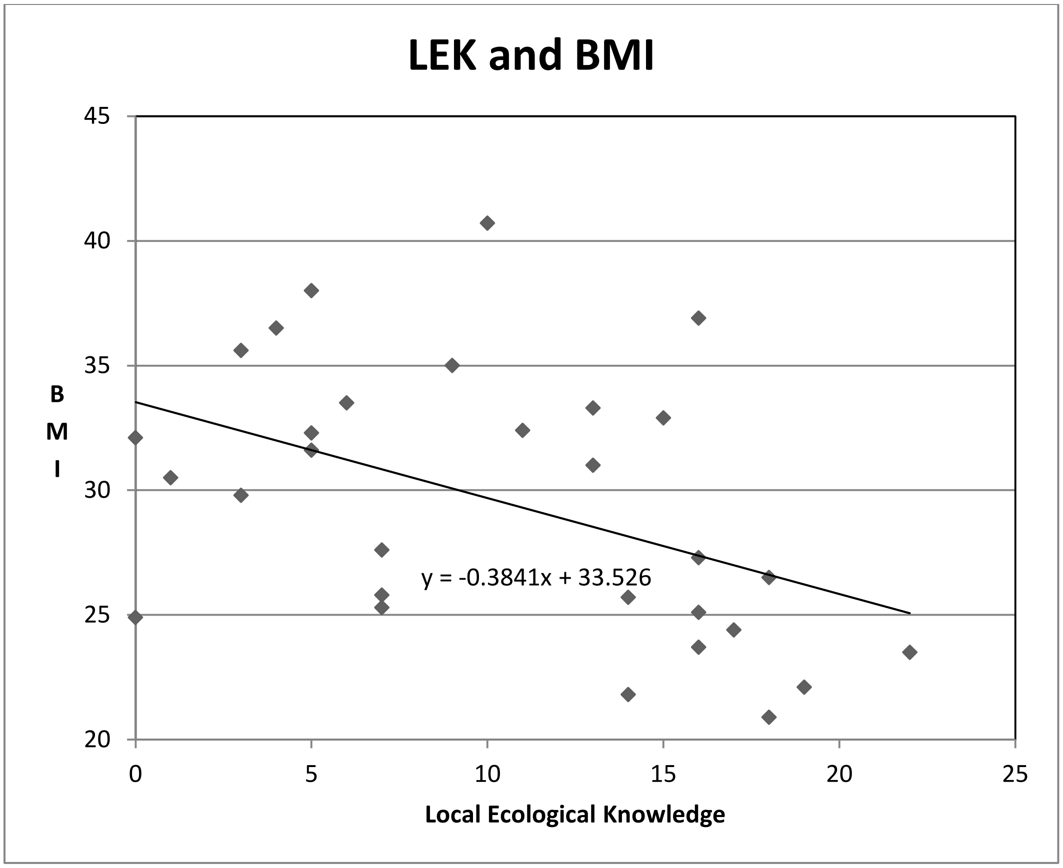

Figure 1 Linearity of LEK and BMI

Table 5: Linear Regression Model of LEK upon BMI

Model	B	SE B	beta
Constant	34.8	1.72	
LEK	-.48	.138	-.550

Table 6: Linear Regression Model of LEK, Age and Gender upon BMI

Model	B	SE B	beta
Constant	32.28	2.55	
LEK	-0.52	0.15	-0.597
Age	0.48	0.06	0.13
Gender	2.55	1.65	0.14

Logistic regression analyses were also performed to measure the effects of LEK upon prediabetes, diabetes, and cardiovascular heart disease diagnoses and a combined variable of these diagnoses. As with the demographic SDH variable utilized earlier, these analyses did not yield any significant results.

CHAPTER FIVE: DISCUSSION

LEK and Health

LEK was chosen as the independent variable within this study because it is not just a body of knowledge, but also inherently includes the behaviors necessary to acquire such knowledge. Localized knowledge of the land and the living and non-living entities residing within the landscape is foundational for the evolution of bodies of knowledge such as LEK, paradigmatic knowledge, institutional knowledge, and worldview (Figure A.1) (Berkes et al. 2000). All of these bodies of knowledge are integrated and embedded within the worldview (Berkes et al. 2000). Though these levels of knowledge are not necessarily distinct from one another, they are rooted in the local empirical knowledge acquired through observation and interaction in a landscape (Berkes et al. 1995; Berkes et al. 2000). The interaction between humans and their local ecology constrains behavioral and cultural responses such as the development of a body of knowledge such as LEK. Thus, LEK is directly related to an individual's behavior, requiring the active engagement of an individual with the land and its resources, something that the Western health models are still struggling to understand (Young & Bjerregaard 2008; Acton et al. 2002; Marmot et al. 2008).

LEK is learned through the practical engagement between a person and their environment (Berkes et al. 2000; Reyes-Garcia et al. 2010). It cannot be transmitted easily through symbolically based texts or oral traditions. The acquisition of LEK requires moving about the landscape and directly interacting with the living and non-living entities that exist therein. Thus, an individual's level of LEK as measured in this study is in direct proportion to their behavior related to such ecological engagement. Even more so, in this research LEK is directly related to both physical activity and diet/nutrition. As the number of species an individual could indentify, prepare, and utilized were measured in order to achieve this.

In this study, LEK has a considerable effect upon BMI in individuals within the study sample. The considerable negative Pearson's correlation observed means that for every increase in the LEK scale experienced by an individual that their BMI goes down by 0.6 points (Figure 1). What's more, LEK alone can explain 30% of the variation within BMI for the sample population. This is of considerable importance when considering all of the other factors that contribute to an individual's current body mass such as genetic heritage, diet, nutrition, physical activity, and socio-economic status, to name a few. Additionally, acquiring and using LEK as an adaptive response to the health and nutritional ailments experienced by Indigenous peoples in North America benefits individuals and nurtures the transmission of traditional culture. Improved health outcomes also increase the likelihood of indigenous people's survival to be able to pass on this body of knowledge to future generations leading to probable cultural revitalization within such populations. Therefore, LEK is an existing body of knowledge and corresponding behaviors that can assist in mediating the prevalence of nutrition-related chronic disease within the FMPST, other American Indian and First Nations peoples, and greater American society.

Hypothesis 1 Was Partially Supported

LEK did correlate negatively with diastolic blood pressure ($r = -.449$, $p < 0.05$), but there was a weak positive correlation with systolic that was not found significant.

Hypothesis 2 Was Also Partially Supported

The logistic regression analyses performed upon the effects of LEK upon previous diagnoses of prediabetes and diabetes type II were found non-significant. However, the linear regression and correlations of the effects of LEK upon BMI, which is certainly a measure of obesity, show significant support for the hypothesis that obesity decreases as LEK increases.

Hypothesis 3 Was Not Supported

Individuals with low levels of LEK did not display multiple chronic health problems and/or diagnoses. However, this could be a function of the young age range within the sample. Furthermore, two of the three respondents with the lowest LEK scale scores were under the age of 25.

Hypothesis 4 Was Supported

As stated previously, LEK had a significantly strong negative correlation with BMI ($r= -5.91$, $p < 0.001$). The linear regression model further supports this hypothesis whereby LEK explains over thirty percent of the variation in BMI. Both of these lines of evidence support the hypothesis that as LEK increases within an individual their BMI decreases.

The FMPST and Sample

The sample taken from the FMPST is different from the national AI/AN population in potentially relevant ways. There are many factors that may be contributing to these phenomena as well as health outcomes. For instance, 96.4% of individuals within the sample have attained a high school diploma or equivalent, which is higher than the national average of 90% and the Nevada average (where tribal members living on the reservation have residency) of 84.4%. There is evidence that formalized education and LEK are in opposition to one another (Reyes-Garcia et al. 2010; Demps et al. 2012). Where the higher level of education one attains is to the detriment of their level of LEK (Reyes-Garcia et al. 2013; Demps et al. 2015). This is likely contributing to a systematic suppression of the transmission of LEK with the FMPST sample and population.

Additionally, the FMPST is experiencing elevated infant and adult mortality rates according to the FMPST Court Statistics Report (Sam 2013) when compared to national statistics from National Vitals Statistics Reports (NVSR) (Xu et al. 2010; Murphy et al. 2013). These factors can also contribute to the suppression of the transmission of information between generations by removing experts from the population (Young 1994; Berkes et al. 2000). But, that does not appear to be the case within the sample populations. In fact two of the three individuals with the highest LEK scores of 19 and 20 are under the age of 30 and one of these two has the highest level of education in the sample. Therefore, the suppression of LEK transmission by such factors as formal education and the death of elder experts is not an issue.

What does appear to be a major influence in suppressing the acquisition of LEK is the systematic removal of indigenous individuals from their local ecology by outside forces. Multiple respondents complained about the mismanagement of reservation properties by the Bureau of Land Management (BLM). However, the age distribution within this randomly generated sample shows a negative skew. This may appear as a result of adult mortality. It more likely reflects the effects of LEK upon health in a younger population. The effects of LEK within this sample population are displaying decreased BMI at younger ages and would have lasting effects upon an individual's health over their lifetime as well as the transmission of said knowledge to future generations. Therefore the promotion of LEK within the FMPST and other indigenous populations will have a significant and longitudinal effect upon the prevalence of chronic diseases such as those investigated within this study.

Implications

There has been a large push within the realms of Health Promotion and Disease Prevention on behalf of the IHS to ameliorate the prevalence of chronic diseases and their predictors within the last decade (NIHB 1998; NDWP 2015). Unfortunately, these efforts have seen little success up to date (DHHS 2012; NDWP 2015), likely as a result of attempting to utilize the Euro-Western ideology surrounding diet and physical activity. There has been a recent effort on behalf of the tribes themselves and organizations such as the Native American Food Sovereignty Alliance (NAFSA) to change the paradigm under which these programs operate by incorporating indigenous perspectives and traditions into such programs as the IHS Diabetes Wellness Program (NDWP 2015; NIHB 1998). One example, which is experiencing moderate success, is taking place within the Dine (Navajo) Nation where there has been a recent revival surrounding traditional foods (NAFSA 2013; NDWP 2015). This tribe has begun the cultivation and raising of traditional food resources and distribute these to tribal members in order to decrease nutrition-related disease and reliance upon the FDPIR (NAFSA 2013). This one of a few examples of the reclamation of traditional resources and knowledge in order to reduce the prevalence of nutrition-related chronic disease within American Indian populations.

This research provides a quantitative example of how traditional knowledge is affecting the prevalence of nutrition-related chronic diseases and their predictors within a North American indigenous population. It should provide grounding in convincing such agencies as the DHHS, IHS, and tribal governments that traditional knowledge and practices such as those embedded within LEK will assist in ameliorating the epidemics of nutrition-related chronic diseases within indigenous populations. Additionally, since LEK is the foundation of culture, the utilization of LEK within disease prevention and health promotion programs will not only improve individual health outcomes but provide a means for cultural revitalization within American Indian tribes. Any efforts to increase cultural diversity are crucial to surmounting the present and looming problems associated with chronic disease, climate change, and the increasing cultural homogeneity resulting from global marketization.

CHAPTER SIX: CONCLUSION

The current state healthcare reform and ever evolving healthcare legislation has championed a more holistic view of health (ACA 2010). In order to achieve this holism healthcare providers and researchers need to change the ways in which they identify and think about the factors that contribute to an individual's current state of health. In order to do so, current models like the SDH would benefit greatly from an evolutionary ecology perspective that embeds the individual as an active participant in their environment along with the socio-economic factors currently identified. Therefore, including traditional practices pertaining to bodies of knowledge, akin to LEK, within health research and healthcare is critical in understanding the variations in health status not only for indigenous and other at-risk populations but American society as a whole. The fact that a strong correlation (-0.591) (Table 4) exists between an individual's level of LEK and their BMI is strong evidence that this body of knowledge improves current health status. Moreover, if LEK can explain 30% (Figure 1) of the variation in BMI, it should be included in current IHS health promotion and disease prevention programs such as the diabetes wellness program within the FMPST.

As this research displays, LEK is an adaptive strategy that can be utilized in improving the health outcomes of individuals, especially within at-risk populations such as the FMPST. Additionally, the promotion of LEK within indigenous populations would have a lasting effect upon both health outcomes and traditional culture. If LEK can be utilized by IHS health promotion and disease prevention programs, the benefits to the community would be two-handed. It would improve the health of the individuals residing within the FMPST, successfully alleviating some of the negative effects of nutrition-related diseases such as diabetes type 2, while promoting traditional practices, behavior, and culture within the tribe. This dual fostering of healthy nutrition and behavior based upon traditional culture provides benefits to indigenous individuals and all humans through ensuring that cultural variation is maintained within North American indigenous populations.

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APPENDIX A

Levels of Analysis in Traditional Knowledge and Management Systems

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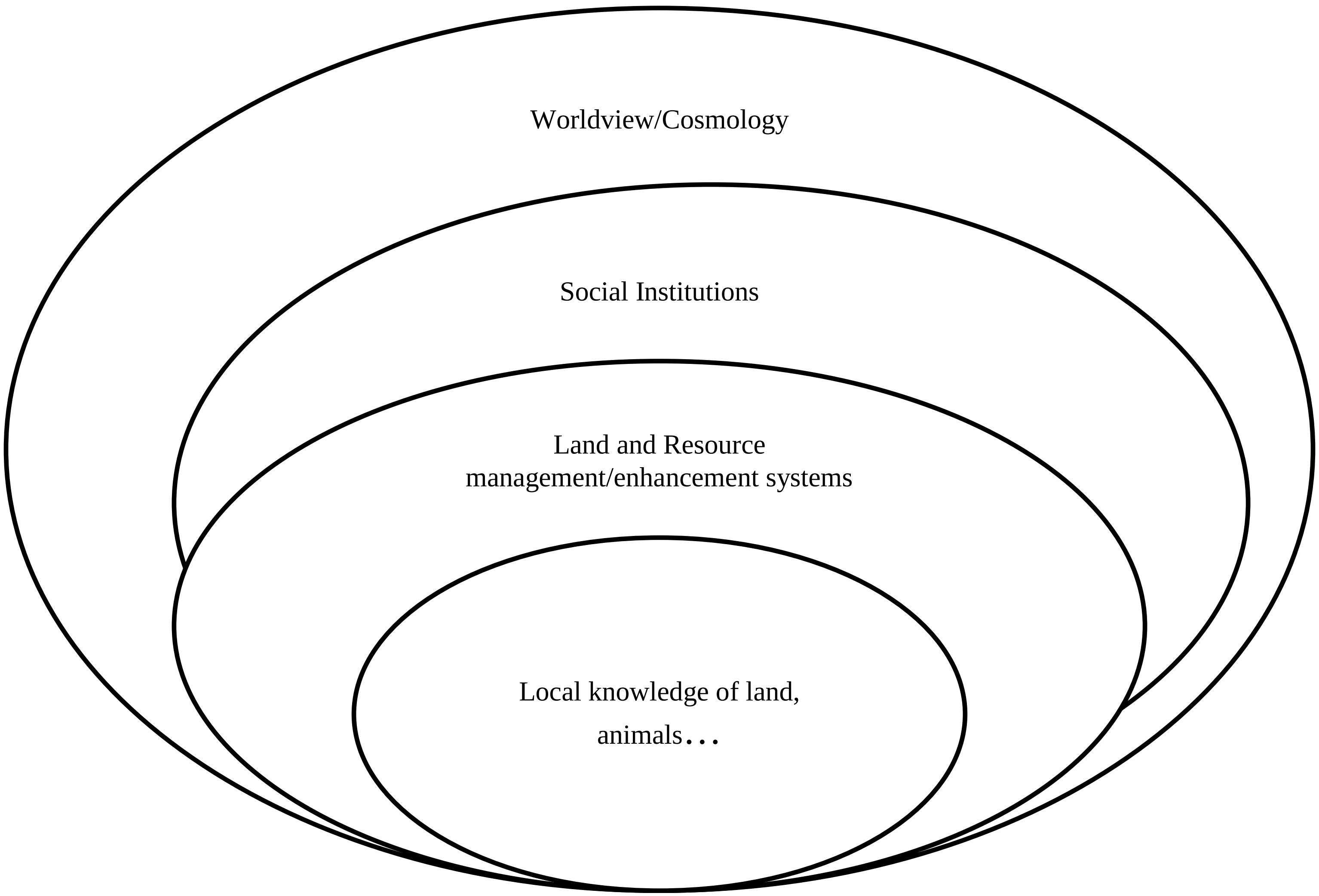

Figure A.1 Levels of Analysis in Traditional Knowledge and Management Systems (Berkes, 2000)

APPENDIX B

Map of FMPST

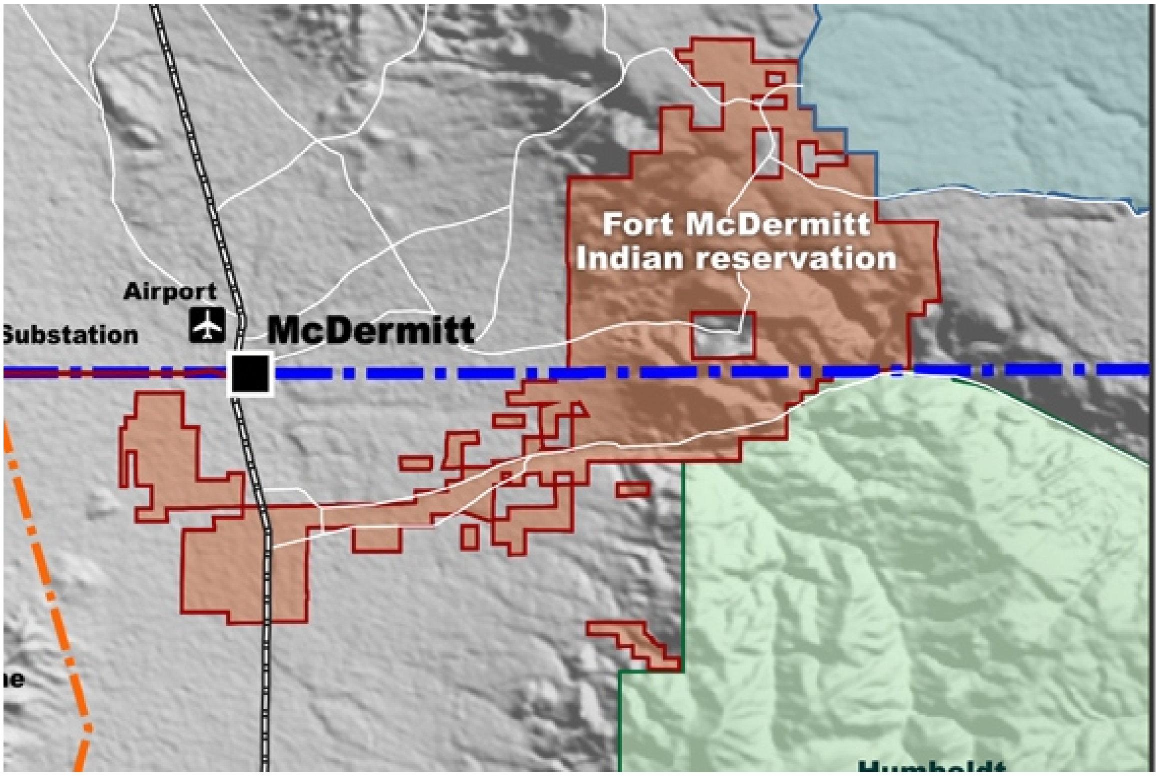

Figure B.1 Map of FMPST

APPENDIX C

IRB Approval Letter

BOISE STATE UNIVERSITY
RESEARCH AND ECONOMIC DEVELOPMENT

Date: June 24, 2014

To: Mark Beil cc: Kathryn Demps

From: Social & Behavioral Insitutional Review Board (SB-IRB)
c/o Office of Research Compliance (ORC)

Subject: SB-IRB Notification of Approval - Original - 028-SB14-094
Local Ecological Knowledge and Chronic Disease within Indigenous North America

The Boise State University IRB has approved your protocol submission. Your protocol is in compliance with this institution's Federal Wide Assurance (#0000097) and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

Protocol Number:	**028-SB14-094**	Received:	6/6/2014	Review:	Expedited
Expires:	**6/23/2015**	Approved:	6/24/2014	Category:	6, 7

Your approved protocol is effective until 6/23/2015. To remain open, your protocol must be renewed on an annual basis and cannot be renewed beyond 6/23/2017. For the activities to continue beyond 6/23/2017, a new protocol application must be submitted.

ORC will notify you of the protocol's upcoming expiration roughly 30 days prior to 6/23/2015. You, as the PI, have the primary responsibility to ensure any forms are submitted in a timely manner for the approved activities to continue. If the protocol is not renewed before 6/23/2015, the protocol will be closed. If you wish to continue the activities after the protocol is closed, you must submit a new protocol application for SB-IRB review and approval.

You must notify the SB-IRB of any additions or changes to your approved protocol using a Modification Form. The SB-IRB must review and approve the modifications before they can begin. When your activities are complete or discontinued, please submit a Final Report. An executive summary or other documents with the results of the research may be included.

All forms are available on the ORC website at http://goo.gl/D2FYTV

Please direct any questions or concerns to ORC at 426-5401 or humansubjects@boisestate.edu.

Thank you and good luck with your research.

Mary E. Pritchard

Dr. Mary Pritchard
Chair
Boise State University Social & Behavioral Insitutional Review Board