

Transitioning from Traditional: Pollution, Diet and the Development of Children

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ABSTRACT

Indigenous people in virtually all parts of the world have transitioned from a traditional way of life to incorporate western culture to some degree. The forces driving these transitions are varied although there are some common features. Today, some traditional communities are exposed to pollution from nearby industries that have been located in undeveloped areas to take advantage of natural resources, inexpensive labor, lax regulations, or other features. Avoiding sources of pollution can safeguard health, but may have untoward consequences. When exposure to pollutants is through components of the traditional diet, people must alter their diet to avoid the pollutants, and in so doing, they transition away from traditional culture. Further, avoiding local, contaminated food involves eating commercial, mass produced foods that can contribute to obesity which is a growing problem worldwide. The choice between eating uncontaminated food from stores or maintaining traditional ways including a traditional diet, is a stressful one adding to the overwhelming stress of acculturation.

Key words: obesity, Native Americans, pollution, diet

Introduction

Transitions come in many forms and are stimulated by many different kinds and combinations of forces. Transitions by Native Americans (American Indians and Alaskan Natives) share similarities with transitions by other aboriginal societies but also are characterized by some very distinctive features.

Like many other aboriginal groups, Native American populations, societies and cultures changed dramatically after contact with European explorers and settlers. In North America, rapid and severe population decline is well documented. (Some estimate that 90% of the original population has been lost since the first European contact although the percentage depends heavily on estimates of population size before 1492¹). Disease played a large role in the population decline. European diseases were often more deadly to the Native Americans than to Europeans and large numbers of natives perished from measles, smallpox and other infections common in Europe². Not all tribes suffered equally and some formerly small tribes became relatively large and vice-versa. Traditional relationships that kept warfare in check among tribes were disturbed by the population shifts. In addition,

some tribes formed alliances with European settlers strengthening some tribes in their warfare with others³.

Most unforgivable were US federal and state governmental policies designed to remove native peoples from ancestral lands and to acculturate Native Americans to Euro-American culture. These policies resulted in near-extinction of Native American people and cultures. Now after more than 500 years of benign and malignant neglect of the well-being of Native Americans and their culture, environmental pollution has emerged as a new force for transition away from the traditional. A case study of the Akwesasne Mohawk community will illustrate how pollution stimulates a transition from traditional values, behaviors and social structures, and will illustrate some of the consequences of the transition.

The People and the Setting

The Akwesasne Mohawk Nation (AMN) is one of several communities comprising the Mohawk Nation whose traditional homeland occupied much of upstate New

York State⁴. The Mohawk are one of the tribes comprising the Haudenosaunee. The Haudenosaunee are also known as the League of Six Nations (originally the League of Five Nations until the Tuscarora were incorporated in the 18th century). The French explorers of the 16th century referred to them as the Iroquois and it is this name that we usually use to refer to this group of tribes. They are linguistically distinct from the neighboring Algonquin tribes such as the Micmac, the Abnaki, the Huron, Mahican, and others.

The Iroquois were one of the earlier groups contacted by European settlers in North America and they are among the most studied of the Native American groups. The early American anthropologist, Lewis Henry Morgan, was fascinated by the Iroquois. In his seminal study of kinship systems published in 1870, he named one of his six kinship archetypes, Iroquois. The Iroquois are also famous for their government that unified previously warring tribes into a confederacy of five nations that many have argued formed the model for the US democracy.

Traditionally, the Mohawk have depended on a combination of agriculture, hunting, trapping and fishing for subsistence⁵. The Three Sisters (corn, beans and squash) was the staple agricultural combination. Hunting was primarily though not exclusively a male activity and provided animal protein. In addition, fish and other riverine species were readily available to communities living on the St. Lawrence River and its tributaries. This combination of Three Sisters agriculture, hunting and fishing is THE traditional means of subsistence. Today families hunt and fish but do not depend on agriculture. One moose can provide meat for a family for the entire year with modern refrigeration. Fish have been a major source of protein in the Mohawk diet for generations and people fished extensively until very recently. Today, Mohawk people at Akwesasne talk about the great fish that used to be caught in the St. Lawrence River.

The society's subsistence system is a cornerstone of its physical survival and its culture. In addition, the dietary pattern and culinary practices complement the central and defining role that subsistence plays in anchoring a culture. People not only define themselves by their diets, but by the methods and values regarding food acquisition and preparation as well. These are part of the heritage each generation passes to the next. Parents and other relatives teach food preferences, food acquisition, food preparation and customs of food consumption (e.g., feast days and feast menus). This teaching is localized in the relations between generations. In the absence of institutionalized education and the World Wide Web, the older generation is the source of information and guidance for the next. When their knowledge seems irrelevant, cultural change may be accelerated.

The Akwesasne Mohawk Nation resides largely on the St. Regis Mohawk Reservation (known as a reserve in Canada) and in many small communities and clusters of homes close by. The members of the nation have not been counted in any census by the US or Canadian gov-

ernments. However, the local population has been estimated at approximately 13,000 people⁶. The reservation itself straddles the St. Lawrence River. It is approximately 80 miles west of Montreal, Canada. The AMN is a sovereign nation as evidenced by the fact that it has entered into numerous treaties with the United States and Canada. Therefore, we describe its location as bordering New York State, Ontario and Quebec, Canada, rather than being in them.

Transition Agents

There are many agents that have propelled the transitions of traditional societies. Records from the 17th century courts of Plymouth Plantation, the first permanent settlement in North America, record the sales of Indian lands to the English settlers³. When English settlers came to what is now New England they entered a world that had been turned upside down by the decimation of some tribal populations due to infectious disease. Local Indians were interested in alliances with Pilgrim settlements in order to obtain allies in a highly fluid power situation in eastern New England.

Another agent, applied some two hundred years later was the forced acculturation of Indian children in boarding schools established by the US federal government^{7, 8}. These Indian schools attempted to drive out the Indian-ness in the children taken from their parents. Prohibited from speaking in their native language, they were instructed in European-based culture and skills needed for employment.

Today economic forces are clear. Most American Indians live in rural areas. Across the US, rural economies are poor ones as employment is scarce. Ironically, gambling has played a role in both the retention and transition of American Indian cultures. In the US gambling is allowed on Indian reservations though prohibited everywhere else but Las Vegas and Atlantic City (NJ). Gambling casinos have become a means for American Indians to add to their economic base. Typically, jobs are created for the construction of the facility and then in support of the casino (greeters, service-staff, card dealers, security, etc.). In addition, the tribal government typically receives some portion of the profits from the casino operating company. Often money obtained by tribes is used to create museums and other venues for the display of Indian cultural artifacts. Individuals earn salaries from casino jobs and that income can pay for individuals' participation in Indian cultural events as well as allow the purchase of modern conveniences and toys (power boats, ski-mobiles, etc.).

However, gambling itself is not the aspect of the local American Indian culture that many Akwesasne residents wish to emphasize. At Akwesasne it is possible to see roadside billboards that advertise casino gambling and within a short distance another billboard that proclaims that gambling is not in »our« culture. Also present at Akwesasne and most American Indian communities is

the relentless advertising for mainstream American culture, clothes, movies, games, and food.

In addition to employment at the casino and the associated hotel, there is employment at cigarette factories. In the US, cigarettes and gasoline are not fully taxed when sold to Indians. There are numerous small smoke shops and gasoline outlets that sell to natives and tourists. A few restaurants and shops are present also although many of these small, undercapitalized businesses seem to have short lifespans. Finally, there is an underground economy that is based on the location of the reservation as it straddles the St. Lawrence River that forms the boundary between the US and Canada. This economy involves moving items that are heavily taxed in the US, or are prohibited.

In the 1950's the St. Lawrence River was enlarged to allow ships to travel from the Atlantic Ocean directly to cities on the Great Lakes. Afterwards, industrial development flourished along the river in the 1960's and 1970's. At that time the Akwesasne community began to be exposed to pollutants, in particular to polychlorinated biphenyls (PCBs) from one or more of the industries along the river⁹. PCBs exist in a large variety of forms varying slightly from a common structure. PCBs are a lipophilic compound that are stable at high temperatures and were added to stabilize hydraulic fluid. They were manufactured by Monsanto and sold under the name of Aroclor. They are now banned in all countries. When they were legal they were used in manufacturing by industries located adjacent to the St. Lawrence River and nearby tributary rivers that cross the Akwesasne Mohawk Nation. Improper disposal of PCB laden fluid and leakages from the machinery allowed PCBs to enter the waterways and the wildlife in and around the river. PCBs all have the same general structure but vary in the degree and placement of chlorine substitutions of carbon in the molecule.

Some varieties (called congeners) of PCBs are highly persistent in the body and the environment. Being lipophilic, they are stored in fat. When a predatory fish eats another fish that has absorbed PCBs from what it has eaten, the predator absorbs the PCBs in the prey. This process results in bio-magnification of PCB levels up the food chain to humans. PCBs can be transferred from mother to offspring across the placenta and through lactation so each generation absorbs some of the PCBs to which the prior generations were exposed.

In the early 1980's exposure to PCBs was suspected at Akwesasne and there followed an environmental crisis that involved members of the AMN as well as health authorities at the local, state/provincial, and national levels. The challenge from the contamination was especially great owing to the location of the Akwesasne community and the issue of Mohawk sovereignty over its territory. The pollution emanated from outside the borders of the reservation recognized by the US and Canada. Therefore, environmental agencies from New York, Ontario, and Quebec were involved as well as federal agencies of Canada and the US. With five legal regulatory agencies

involved, there was not one way forward and each legal entity had its own regulations to follow. In addition, because AMN is a sovereign nation, it claimed control over its borders and the remedies for the pollutants therein. Nevertheless, the US and Canada, as well as NY, Ontario and Quebec sought to enforce its environmental laws within the territorial borders of the AMN. Predictably, cleaning up the environment was going to take a tortuous course over a considerable period of time. The area was declared a US Federal Superfund Site and NY authorities labeled it a superfund site as well. These designations are testimony to the presence of environmental contamination.

Before any clean-up of the environment occurred, fish advisories were issued warning people not to consume, or to limit consumption, of local fish because contamination of local fish with PCBs^{10,11}.

The concern with PCB exposure was well-founded. Akwesasne youth, 10–16.9 years old who participated in our study from 1996–2000 exhibited levels that were high relative to levels in the US¹². The mean level (geometric mean) of PCBs among the Akwesasne youth fell between the 90th and 95th centiles of reference values for the US population^{13, 14}. Other pollutants (specifically, *p,p'*-DDE and lead) did not have comparably high values at all.

The Biological Transition

Effects of PCBs

Why be concerned about PCBs? PCBs in general are endocrine disrupting compounds^{15–18}, however not all PCBs act the same. There are about 100 different varieties (called congeners) that differ in structure and can be found in the environment. The structure has a large effect on the persistence and toxicity of each congener. Some have few effects that we know of while others have effects that are now well established.

What are the biological changes associated with PCB exposure?

We have conducted two studies at Akwesasne and are in the midst of a third. Results from the first two studies have established three important effects. In the first study we found indications that sexual maturation was altered by PCBs. First we found that age at menarche was younger in relation to PCB levels in the girls¹⁹. More recently we found that the level of testosterone was reduced in adolescent boys in proportion to their PCB level, particularly the ones with the long half-lives that index earlier exposure. These two effects, one pro-estrogenic and the other anti-androgenic, though apparently in opposite directions, are consistent with classic endocrine disruption from exposure to PCBs. The PCBs mimic naturally produced estrogen and testosterone, but with varying degrees of accuracy. The result can be either stimulation or inhibition.

Among the adolescent boys and girls, we also found that the level of PCBs was associated with changes in hormones that regulate the thyroid gland's activity. The thyroid gland has numerous functions including the regulation of basal metabolic rate, and in prenatal life it facilitates the development of the CNS. We found that thyroid stimulating hormone from the anterior pituitary was significantly elevated in relation to PCBs, particularly the ones with long half-lives, and that the level of free thyroxin (unbound in serum and available to the tissues) was depressed in relation to PCB exposure²⁰). This is the classic pattern for depressed thyroid activity. Elevated TSH is a clinical sign of hypothyroidism which has symptoms of fatigue, greater sensitivity to cold, heavier menstrual periods, depression, slow mentation, and weight gain. The fact that the relationship was strongest with PCB congeners with long half-lives suggested that the critical exposure may have occurred in the past. Further we saw that congeners that metabolize quickly and are only found when exposure is recent were not associated with effects. Together these different relationships suggest some type of thyroid programming earlier in the lives of these adolescents, either prenatal or in early postnatal life.

No one has discovered how thyroid programming by any toxicant occurs. It also is possible that the diminished thyroid activity may be due to autoimmune pathology. Actually, both processes could be involved. Autoimmune activity acting against the thyroid gland is known. Our second study at Akwesasne was a follow-up of the adolescents and was conducted between 2000 and 2007. The adolescents, now young adults, who had elevated antibody to the thyroid gland (anti-thyroid peroxidase antibody abbreviated as TPOAb) had significantly higher levels of PCBs and *p,p'*-DDE²¹. Elevated TPOAb indicates autoimmune activity generally and is usually elevated in one of the most common autoimmune diseases acting against the thyroid (e.g., Hashimoto's thyroiditis). It also is elevated in association with many other autoimmune disorders such as polycystic ovary syndrome, Graves Disease, lupus, and others. Significantly, the relationships with PCBs were with the persistent forms and not the ones reflecting current exposure, again suggesting that much earlier exposures were responsible.

Endocrine Disruption: A source for overweight?

It is plausible that reduced thyroid activity could lead to weight gain and more overweight and obesity at Akwesasne, and it seems likely given results from anthropometric studies of the Akwesasne 10–16.9 year olds. The weights of boys in our study tracked along the age-specific 90th centile of CDC reference values while the weights of girls approximated the 85th centile in every year. In these same adolescents, heights of both boys and girls approximated the 50th centiles²². The average BMI of boys is at or above the 90th centile and the average girls' BMI is at or above the 85th centile. An astonishing 59% of the adolescents are overweight or obese. Today many American Indian groups have high rates of

overweight and obesity. What is remarkable about Akwesasne is the speed of the obesity epidemic there and the timing of the epidemic compared to the timing of the exposure to PCBs.

Since 1981 when the first highly reliable set of measurements of Akwesasne youth were made^{23,24}, the average weights of boys has increased from 11–22 kg. In other words, 8 year old boys measured between 1996 and 2000 were some 22 kg or 50 pounds heavier than same aged boys measured less than 20 years earlier while no change in average heights occurred²⁵. Females also gained weight over this period but the gains were not as substantial. Body mass indices of the Akwesasne boys exceed the NHANES II 90th centile by a large margin, as well as the St. Regis boys measured 15 years earlier and the boys sampled in a national survey of American Indian growth (Figure 1).

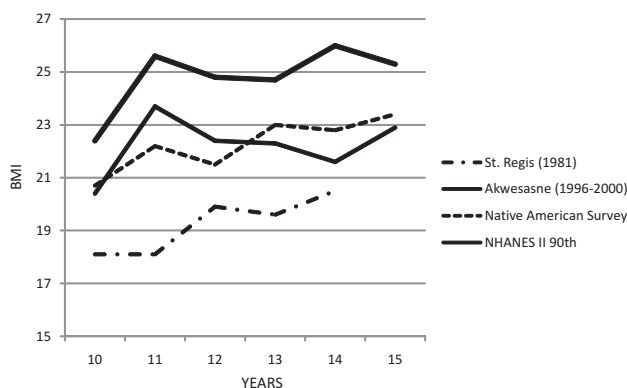


Fig. 1. BMI of Akwesasne boys measured between 1995–2000 compared to earlier studies of Akwesasne boys (St. Regis), a national survey of Native American children, and the NHANES II 90th centile.

Thus, one important transition made at Akwesasne seems to be a biological one. Like many communities in industrialized and industrializing economies, young people are becoming larger, fatter, and at greater risk for weight related diseases such as diabetes, cardiovascular diseases, and stroke, as well as autoimmune diseases. The community at Akwesasne is well aware of their vulnerability and the high rates of early deaths among their not-so-very-much older members. Pollution exposure can be seen as another mechanism to destroy the health of American Indians and hasten their demise.

Exposure to pollutants may be a contributor to the increased frequency of overweight and obesity but weight is usually related to diet as well which in turn is related to food choice, and this too has become an issue at Akwesasne.

Dietary Transition – Cultural Transition

Aside from exposure through a few specific occupations, the primary route of exposure to PCBs and many other toxicants is through the diet. This is especially so

for lipophilic toxicants. Other than diet, the sources are from transplacental passage and breast feeding. Persistent PCB congeners can remain in a woman's adipose tissue and be off-loaded to the fetus and infant long after the mother's original exposure ended. Thus, the advisory to stop eating locally caught fish had an impact on Akwesasne mothers, and mothers-to-be especially. Until the advisories were issued, no one was aware that locally caught fish posed any risks to health and in fact, fish is generally considered a healthy food.

If breast milk is contaminated and breastfeeding is avoided, the loss affects some of the fundamental pillars of Mohawk culture at Akwesasne. Mohawk society is traditionally matrilineal. Breastfeeding has important socializing functions at Akwesasne as well as having important immunological and psychological benefits. The status of Mohawk women is linked to breastfeeding and then so too to the health of the environment. Akwesasne women have had high rates of breastfeeding initiation (84%). The contamination of the fish and the persistence of PCB congeners in the bodies of girls and women can discourage people from breast feeding and this may affect the status of women in society.

Dietary traditions may be changing also. Traditionally and certainly over the last 100 years, residents fished the St. Lawrence River extensively. However, the possibility that these fish and other local food species might be contaminated pushes people towards more consumption of store bought items characteristically high in fat, calories, and sodium.

Recent research of ours has established that consumption of locally caught foods is associated with higher levels of the more persistent PCBs. Young Akwesasne adults who ate locally produced foods in the past year had significantly higher levels of PCBs, particularly ones reflecting past exposure rather than recent exposure^{13,15}.

Given the importance of diet to cultural definition and delineation, changing diets at Akwesasne away from traditional foods represents a clear loss of Mohawk culture²⁶. In a society where culture has been under concerted attack for generations, the loss of dietary items is a severe blow. However, it is more than that. Westerners can avoid a few foods easily as we are accustomed to using grocery markets for all foods, but it is not easy for Native people. The damage is more than a shift in diet^{13,27}. Traditional foods were acquired by traditional means of hunting, fishing and trapping, and were prepared by traditional methods. This knowledge was passed from the older generations to the younger ones and formed important connections between them. Without the relevance of the older generation's knowledge, the younger ones are less connected to Mohawk culture and more susceptible to western influences. This entire set of traditions around food and the ties between generations are what is truly the issue and not merely cuisine.

Conclusions

Avoiding exposure to the contamination of the St. Lawrence River is not simply a matter of moving away.

The land now occupied by the Akwesasne people is a foundation for the culture and society. There are strong ties to the land. Giving up the land and moving away is not an option as it would be for any suburban middle class member of the dominant culture in the US who discovered toxic waste nearby.

Avoiding foods that may be contaminated is not a simple matter either. The »dietary dilemma« is the forced choice between healthy food OR healthy traditions. It exists in the context of a long history of oppression and even extermination of American Indians that the Akwesasne community hardly escaped²⁸.

Simply avoiding a few foods is not the issue. In every trip to the grocery store, and at every meal, residents must make a decision about health and about preserving culture. The location of this decision-making is the issue. At present it is made by individuals. However, it could be made by governments and industries through a clean up of the contamination.

In fact, larger political and economic forces operating at Akwesasne make avoiding toxicants in food a destructive influence on local Mohawk culture. If Akwesasne residents were to be free to continue catching, preparing and eating locally caught foods that are no longer contaminated, the local pollution would have to be removed from the environment. This is not something an individual can do. Cleaning up all the contamination that has entered the St. Lawrence River and the food chain is a responsibility of those who contributed the pollution and the governments that oversee the protection of citizens. However, there are two Canadian provinces and one US state involved, as well as two federal governments. Each of these views the clean-up differently and all seem to view it differently than the Mohawks.

Without an environmental clean-up, the public health message is to avoid locally caught foods. This approach does not make the corporations that polluted nor the government agencies charged with environmental protection responsible, but places the responsibility for a safe diet on the individual resident. Thus, each individual, each day has the responsibility for choosing a safe diet and each has the stress that goes with that difficult decision on a daily basis.

Akwesasne residents feel a great deal of stress we are told. Stress comes from the attacks on culture, from a difficult economy, from poor health, from the short lifespans of family and friends, and it is compounded by not knowing what to eat. It is like not knowing what to breathe. Other investigators have shown connections between stress, overweight and health²⁹. Stress adds to the risks that have accumulated in the community that are seen as responsible for the high rates of diabetes, cardiovascular disease, and the generally low life expectancy that characterized North American Native American communities^{30–32}. The dietary dilemma at Akwesasne contributes to the transition of this society and culture very much against their will. What will Mohawk culture be without the traditional means of subsistence and the traditional connections among generations?

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TRANZICIONIRANJE OD TRADICIONALNOG: ZAGAĐENJE, PREHRANA I RAZVOJ DJECE

SAŽETAK

Autohtono stanovništvo u gotovo svim krajevima svijeta u određenom je stupnju već prošlo kroz tranziciju s tradicionalnog načina života u životni stil zapadne kulture. Sile koje pokreću ove tranzicije vrlo su raznolike, no sve imaju neke zajedničke karakteristike. Određene tradicionalne zajednice danas izložene su zagađenju obližnjih industrijskih pogona koji su smješteni u nerazvijenim područjima kako bi iskoristili tamošnje prirodne resurse, jeftinu radnu snagu itd. Izbjegavanje izvora zagađenja može zaštititi zdravlje, no može imati i neke nepredviđene posljedice. Kada je izloženost zagađenosti povezana s tradicionalnom prehranom potrebno je promijeniti samu prehranu i pri tome dolazi do tranzicije i odmaka od tradicionalne kulture. Također, izbjegavanje lokalne, tradicionalne prehrane znači konzumiranje komercijalne, masivno proizvedene hrane koja doprinosi razvoju pretilosti, jednom od vodećih zdravstvenih problema današnjice. Izbor između konzumiranja nezagađene hrane iz dućana ili zadržavanje tradicije, a time i tradicionalne prehrane nije lak i doprinosi ionako velikom akulturacijskom stresu.