The legacy of the Alaska Siberia Medical Research Program: a historical perspective

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ABSTRACT

Background. The Alaska Siberia Medical Research Program was established at the University of Alaska (UA) at a time when there was no research funded by the National Institutes of Health (NIH) that was concerned with Alaska Native health issues. The program grew out of a dire need for an understanding of the apparently rapidly growing health problems in the Native community. The initial plan included the following objectives.

Objectives. The objectives are to develop a self-sustaining infrastructure for biomedical research by gaining support from Alaska Natives, UA, national political leaders, NIH and the Russian Academy of Medical Science (RAMS); to identify researchers committed to helping Alaska Natives; to develop meaningful, Native-driven participatory research; to carry out necessary research to form the foundation for future research; and to develop circumpolar collaborations.

Results. The objectives were achieved because of the extraordinary and cheerful contributions by all participants in the program. The collaborative research resulted in some 70 published manuscripts identifying and characterizing research-neglected health problems. Unique risk factors for diabetes, cardiovascular disease, alcoholism and seasonal affective disorders were characterized and institutionalized prevention programs were established. The effort of the program led to U.S. Congressional action establishing the University of Alaska as a minority institution, leading to the funding of a variety of successful NIH-funded research centres and programs at the university that are concerned with Native health problems.

Conclusion. A small, visionary investment by the University of Alaska for establishing the program led to a co-operative effort by the UA, RAMS, Alaska Native Health communities and the NIH that resulted in the development of self-sustaining medical research efforts in Alaska and Siberia. The program spawned pilot studies, leading to NIH-funded research that has provided fundamental insights into the etiology of health problems and their reduction by research-based intervention and prevention programs.

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INTRODUCTION

This historical perspective was written to elucidate what was required to develop an urgently needed medical research program in Alaska and what was accomplished by it. The insights gained from the development of the Alaska Siberia Medical Research Program (ASMRP) illustrate how many individuals and organizations worked together to make an idea into a reality. The ASMRP was established at the University of Alaska (UA) out of a dire need for understanding the rapidly growing health problems among Alaska Natives at a time when there was no research funded by the National Institutes of Health (NIH) that was concerned with Alaska Natives.

When the President of the UA asked me to take over the Alaska Siberia Medical Research Program (ASMRP) in 1988, after Dr. Ted Mala left the program (1,2), the instructions were simple: “Determine if it is feasible to establish a meaningful research collaboration with the Russian Academy of Medical Science.” Since the president promised seed money for pilot studies, I accepted the challenge because I realized that it might lead to research on Alaska Native health problems. This need led to an initial plan that included the following objectives:

(1) To develop self-sustaining infrastructure for biomedical research by gaining support from Alaska Natives, UA, national political leaders, NIH and the Russian Academy of Medical Sciences (RAMS).

(2) To identify and recruit researchers committed to helping Alaska Natives.

(3) To develop meaningful, Native-driven participatory research.

(4) To carry out necessary research to establish the foundation for future research.

(5) To develop circumpolar collaboration.

The collaboration began with a visit to Novosibirsk, Russia, in 1988, where I had a chance to select distinguished potential research collaborators in the Russian Academy of Medical Science with the help of my counterpart, Academician Valery Trufakin, Vice-President of the Academy. Returning to Alaska, researchers from the UA, Centers for Disease Control and the Alaska Native Medical Center were persuaded to explore the possibility of collaboration. The focus in Alaska related to helping Alaska Natives with their research-neglected health problems. In Russia, the focus was on Siberian Native people. The UA funded the exploratory project with $50,000. This was sufficient to establish the ASMRP at the University of Alaska and to allow visits back and forth to Siberia and to establish 8 research teams (1) and start research that eventually led to some 70 scientific publications (3–68). Over the years, some collaborations led to self-sustained NIH funded research, while others failed when they were unable to obtain research grants. In the end, the collaboration with Russia ceased because of the lack of funding for travel related to the collaboration, but the University of Alaska projects blossomed with the support of the National Institutes of Health.

The collaboration in ASMRP involved exchanges between scientists visiting each other for extended periods of time. Thus, C Korolenko spent valuable and productive times with B Segal that resulted in substantial publications (3–11,17) and a book dealing with alcoholism (5). AV Avksentyuk spent months working in L Duffy’s laboratories in Fairbanks that resulted in important papers related to alcoholism and genetics (12–25). MI Voevoda worked with GF Shields in Fairbanks on mitochondrial DNA studies (26–34). F Mamleeva worked with ED Nobmann comparing diets of Siberian Inuit with...
those on St. Lawrence Island in Alaska (35–41). I also collaborated with KV Danilenko and AA Putilov on melatonin and its role in seasonal affective disorders, fatigue and immune function (42–48). V Cherapanova worked with R Elsner on the diving reflex (49) and Y Nikitin and Shubnikov worked with me and other members of the Alaska team on diabetes (DM) and cardiovascular disease (CVD) (50–69). The Genetics of Coronary Artery Disease (GOCADAN) study evolved from the ASMRP and continues to this day (70–84). The ASMRP also spawned the birth of true participatory research in Alaska (50,56) and collaboration with researchers working with Inuit in Greenland and Canada (61,62,68,74).

The initiative also led to a search for federal funding for a medical research center at the University. This involved U.S. Senator Ted Stevens, who made it a mission to find the right mechanism. After a year, he involved Senator Daniel Inouye and they suggested that I organize a brainstorming session in Hawaii with both of their staffs to solve the dilemma. The result of that session was an ingenious solution: designation by the U.S. Congress of the University of Alaska as a “minority institution.” This gave access to many National Institutes of Health programs which resulted in federal funding opportunities for the creation of medical research centers and programs related to minority health at the University. This included the Center for Alaska Native Health Research and the Basic Neuroscience Program at the University of Alaska Fairbanks. The apparent rapid increase in DM and CVD among Alaska Natives also led to a priority effort in the Norton Sound region.

Diabetes (DM)
The idea to study diabetes came from a casual comment by Academician Yuri Nikitin on my first visit to Russia, to the effect that diabetes was extremely rare among Inuit in Siberia. Knowing that rates of DM and CVD among Alaska Natives were increasing rapidly, a need and an opportunity for research collaboration became clear. With the help of Cynthia (Cindy) Schraer, a grant application to the National Institute of Diabetes and Kidney Disorders (NIDDK) was funded to determine the prevalence of DM and identify associated risk factors among Siberian Yup’ik Inuit. We focused on this ethnic group because of our plans to study related groups in Siberia with Academician Nikitin. This was followed by another NIH grant to study the prevention of DM (50–67). That study is referred to as the Alaska Siberia Project (ASP). Based on our research findings, an institutionalized diabetes prevention program was established in Nome by Michael Swenson, one of our collaborators in the ASMRP (67). Early on, we verified general perceptions that CVD and DM have increased rapidly since the 1960s, when the prevalence of DM was less than 0.2% and heart disease less than 2% (85,86). Our comparable screenings in the Norton Sound region in 1992 and 1994 showed a prevalence of 8% and 15% respectively (56,65). In one ethnic group, 44% of women ≥55 years of age had abnormal glucose tolerance (DM, 19% + IGT, 25%). One early finding was that this high prevalence is partially related to a dietary shift from healthy traditional fats (omega-3 fatty acids (FAs) and monounsaturated FAs) to a high consumption of saturated FAs found in store-bought foods (59). High consumption of palmitate, a saturated FA that is found in high concentrations in shortening, butter, bacon and other farm animal fat, is strongly associated with insulin resistance, impaired glucose tolerance and pre-diabetes, suggesting a probable role in the development of DM (59,67) and CVD (78). A successful 4-year diabetes prevention study, in
which reduced consumption of sugar and palmi-
tate-containing foods was stressed, appeared to
confirm the original hypothesis of this fat (59).
In that study, out of 44 subjects who began the
study with impaired glucose tolerance, only one
person developed DM in 4 years as compared to
the expected 40–50%. The prospective study by
Vessby et al. (87) also showed that palmitate and
myristic acids are associated with the develop-
ment of diabetes.

Coronary heart disease
Recognizing the growing burden of CVD in the
Inuit population, I reached out to David Robbins
at the MedStar Institute in Washington, DC, and
with the help of Jean MacCluer and Barbara
Howard the grant application to the National
Heart Lung and Blood Institute for the Genetics of
Coronary Artery Disease in Alaska Natives Study
(GOCADAN; 70–84) was developed on the basis
of the ASP results. We are now following some
1,900 Inuit in a very detailed, Framingham-type
study with systematic and periodic screenings
in villages in the Norton Sound region. In the
first completed screening of 7 villages, we had a
participation rate of 82.6% of those older than 17
years of age (71). The study includes detailed
blood chemistry, genetic studies and interviews
on nutrition, health history and family rela-
tionships in addition to ECGs and ultrasounds of
the carotid arteries (70,78,80). Together, ASP and
GOCADAN are providing new insights into the
sometimes unique risk factors for DM and CVD
in this population.

The first systematic population-based study
of CVD in Alaskan Inuit in ASP revealed a prev-
alence of 15% in the age group 45–74 (63,65).
These results are similar to those recently
obtained in the GOCADAN study (70). This
high prevalence reflects the high mortality rate
of Alaska Natives from coronary heart disease
CHD (40% greater than that of U.S. whites aged
45–54; 4). The results are significantly different
than the <2% reported in the 1960s (86) and
those reported in Greenland in 1980, which
showed that "coronary atherosclerosis is almost
unknown among Greenlandic Eskimos when
living in their own cultural environment" (88).
That low prevalence was interpreted to result
from the high consumption of marine ω-3 FAs
(88), although no screening was done. Our
studies have shown no such association between
marine ω-3 FA consumption and the presence of
CHD (63). On the other hand, our studies show
that over-consumption of saturated FAs is asso-
ciated with the presence and extent of carotid
plaque (78) and with other CVD risk factors
such as glucose intolerance (59,67,82), blood
pressure (67,77) and elevated heart rate (83,84).
These findings support the prospective studies by
Vessby’s group in Sweden that recently showed a
direct link between serum levels of the saturated
myristic and palmitic FAs and cardiovascular
mortality (89).

Thus, although the value of ω-3 FA consump-
tion is well known to reduce cardiovascular
mortality, it appears not to be related to
preventing atherosclerotic plaque as previously
thought, but rather to reducing arrhythmia,
sudden death (90), blood pressure (66,77) and
heart rate (83) and improving plaque stability
(91) and glucose tolerance (66,67,77,82,83).

Stroke
Cerebrovascular disease has become a major
health problem among Inuit as the incidence of
stroke is now 50% higher among Alaska Natives
as compared to U.S. whites (92). In our 1994
screening, we found evidence of previous stroke
in 10.8% of the normoglycemic women and in
12.8% of the normoglycemic men, and in 18.8% of the women and 8.3% of the men with abnormal glucose intolerance (65). It is clear from Trimble’s (93) study of Yup’ik Inuit that most strokes (79%) are ischemic and related to the high burden of carotid plaque that we discovered in Inuit (78,80). This burden of plaque is uniformly higher than in U.S. whites and black populations (78,80). Our studies show that although not associated with ω3 FAs, the presence and extent of plaque are associated with smoking and consumption of the saturated FAs palmitate and stearic acid (76,78).

**Participatory research**

The principles of participatory research were followed from the beginning, and, I believe, resulted in the exceptionally high participation rate (83% in 7 villages) and goodwill among participants and researchers. The kindness expressed by the Natives has been exceptional; I have been fortunate in being able to make some 7,000 home visits over the last 20 years to explain the research and the results. Hundreds of individuals with abnormal screening values were referred to health care providers. Over the years, I have not had a single negative interaction with the Inuit. In fact, the unadulterated enthusiasm by the Native communities for our research has been a steady reinforcement for our approach. In the intervention study (67), ladies would run out into the street from their homes shouting: “Dr. Ebbesson, I feel so good, I have lost 15 pounds (for example) and I am doing everything you say.” One claimed that she lost 72 pounds in 4 years. The “guide for prevention of DM and CVD” based on our research results, which was given to all participants, has become very popular (Appendix 1). It reflects our mission to conduct participatory research with a goal to help the communities with disease prevention.

**Conclusion**

A small, visionary investment by the University of Alaska for establishing the program has, in 20 years, led to meeting the original objectives. Considerable progress has been made in elucidating the rapidly growing health problems among Alaska Natives by a diverse cadre of investigators recruited for the effort. A co-operative effort by the UA, RAMS, Alaska Native Health communities, the NIH and collaborators in Canada, Denmark and Sweden has resulted in the development of self-sustaining medical research efforts in Alaska and Siberia. The objectives of the program were achieved because of the extraordinary and cheerful contributions by all participants in the program. The collaborative research resulted in some 70 published manuscripts identifying and characterizing research-neglected health problems including alcoholism, seasonal affective disorders, diabetes and cardiovascular disease. These studies form the basis for ongoing participatory research on many fronts.

**Publications:**
- Doctoral theses: 2
- Books: 1
- Articles in Arctic Medical Research: 10
- Articles in *International Journal of Circumpolar Health*: 16
- Articles in other international journals: 54
- Articles in ICCH’s Circumpolar Health volumes: 5

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REFERENCES

1. Ebbesson SOE, Nikitin YP. The Alaska-Siberia Medical Research Program makes progress. Arctic Med Res 1989;48:27–28.
2. Mala TA. The Alaska-Siberia Medical Program: 24 years in retrospect. Alaska Med 2007;49(2):46–48.
3. Balunov OA, Segal B. Development and organization of alcohol services in Leningrad, USSR. Int J Addict 1986; 21(1):97–103.
4. Segal B, Korolenko C, editors. Addictive disorders in arctic climates: Theory, research, and practice at the Novosibirsk Institute. Drugs & Society 1990;4(3/4).
5. Segal B, Korolenko C, editors. Addictive disorders in arctic climates: Theory, research and practice at the Novosibirsk Institute. New York: Haworth Press; 1990. 118 p.
6. Segal B, L. Haptoglobin levels among alcoholics in Alaska. Arctic Med Res 1991;50(4):166–169.
7. Dunskih TA, Korolenko CP, Segal B. Alcoholic behavior in homeless people. In: Medical Social Aspects of Mental Health. Tomsk, Russia: Institute of Mental Health; 1991.
8. Korolenko CP, Segal B, Donskih TA. Ecological psychiatry necessary to form new directions in science. Barnaul, Russia: Barnaul Medical Institute; 1991.
9. Segal B, Korolenko C. The study of addictive behavior in Siberia: Implications for research in circumpolar nations. Circumpolar Health 90. Proceedings of the 8th International Congress on Circumpolar Health, Manitoba: The University of Manitoba Press; 1991. p. 320–322.
10. Segal B, Duffy LK, Kurilovitch SA, Avksentyuk AV, Alaskan and Siberian studies on alcoholic behavior and genetic predisposition. Arctic Med Res 1991;50(Suppl):474–477.
11. Korolenko C, Donskih TA, Segal B. Alcoholic behavior in homeless people. In: Mental Health Science. Tomsk, Russia: 1991.
12. Thomasson HR, Khartonik AM, Avksentyuk A, Duffly L, Segal B, Li T-K. Alcohol and aldehyde dehydrogenase allelic frequencies in Eskimo, Native American, and Siberian peoples. Alcoholism 1992;16(3):605.
13. Avyssentuk AV, Jurilovich SA, Kurshinov VN, et al. Prevalence of atypical alcohol and aldehyde dehydrogenase among Chukotka Natives. In: Human Genetics and Pathology. Tomsk, Russia: Tomsk University Press; 1992. p. 48–50.
14. Segal B, Duffy LK. Ethanol elimination among different racial groups. Alcohol 1992;16(3):213–217.
15. Goedde HW, Agarwal DP, Fritz G, Meier-Tackmann D, Singh S, Beckmann G, et al. Distribution of ADH2 and ALDH2 genotypes in different populations. Hum Genet 1992;88(3):344–346.
16. Kurilovitch SA, Avksentyuk AV, Segal B, Galaktionov OK, Yakushenko IA, Duffly L. Specific features of alcohol consumption and mitochondrial aldehyde dehydrogenase genotype in male Natives of Chukotka. Vestnik Rossiiskoi Akademii Meditsinskikh Nauk 1994;2:28–30. (Proceedings of the Russian Academy of Medical Sciences.)
17. Korolenko C, Minevich V, Segal B. The politicization of alcohol in the USSR and its impact on the study and treatment of alcoholism. Int J Addict 1994;29(10):1269–1285.
18. Kurilovich SA, Avksentyuk AT, Segal B, Galaktionov IE, Jakuschenko IA, Duffy LK. Peculiarities of alcohol consumption and genotype of mitochondrial aldehyde dehydrogenase in Chukotka Natives. Vestnik Rain 1994; 2:28–30.
19. Segal B, editor. Biobehavioral studies of drinking. Drugs & Society 1994;8(2):1–70.
20. Avksentyuk AT, Nikitin YP, Kurilovich SA, Segal B, Duffy LK, Astakhtova TI, et al. Drinking and genetic factors among Russians and Chukotka Natives in Siberia. Drugs & Society 1994;8(2):5–50.
21. Avksentyuk AV, Kurilovich SA, Duffy LK, Segal B, Voeyoda MI, Nikitin YP. Alcohol consumption and flushing in Chukotka Natives (Siberia). Journal of Alcohol Studies 1995;56(2):194–201.
22. Segal B, Duffy LK, Avksentyuk AV, Thomasson HR. Biobehavioral factors and drinking among Alaskan and Siberian Natives: cross cultural collaborative research. In: Proceedings of the 9th International Congress on Circumpolar Health. Circumpolar Health 93. Arctic Med Res 1994;53(Suppl 2):568–572.
23. Putilov AA, Danilenko KV, Russkikin GS, Schering SM, Duffly LK, Ebbesson SOE. Melatonin relates to immune system in Seasonal Affective Disorder. Advances in Pineal Research 1993;7:173–177.
24. Putilov AA, Danilenko KV, Russkikin GS, Duffy LK, Ebbesson SOE. Melatonin in Seasonal Affective Disorder. In: Proceedings of the 9th International Congress on Circumpolar Health. Circumpolar Health 93. Arctic Med Res 1994;53(Suppl 2):480–482.
25. Duffy LK, Segal B, Avksentyuk AV, Thomasson HR, Levine ME. Genetics, neuroimmune interactions and alcoholism at high latitudes like Alaska. In: Meekan RH et al., editors. Bridges of Science between North America and the Russian Far East: Proceedings of the 45th Arctic Science Conference, Anchorage, Vladivostok: Geophysical Institute Press; 1994. p. 283–291.
26. Shields GF, Hecker K, Voeyoda MI, Reed JK. Absence of the Asian-specific region V mitochondrial marker in Native Beringians. Am J Hum Genet 1992;50(4):758–765.
27. Shields GF, Schmichek AM, Frazier BL, Reed JK, Voeyoda MI, Reed JK, et al. mtDNA sequences suggest a recent evolutionary divergence for Beringian and northern North American populations. Am J Hum Genet 1993;53(3):549–562.
28. Shields GF. Molecular evolutionary genetics of Indigenous northern populations. Prehistoric Alaska, Alaska Geographic 1994;21:102–104.
29. Voeyoda MI, Avksentyuk AV, Ivanova AV, Astakhtova TI, Babenko VN, Kurilovich SA, et al. Molecular genetic studies of a population of Indigenous inhabitants of Chukotka: an analysis of mitochondrial DNA polymorphism and genes of alcohol-metabolizing enzymes. Siberisk Ekologich Zh 1994;1:149–162.
30. Ivanova AV, Voeyoda MI, Zakazovtseva MA, Avksentyuk AV, Astakhtova TI, Bibi BR, et al. Restriction-deletion polymorphism of mitochondrial DNA region V in some populations of aboriginal residents of Siberia and the Far East. Genetika 1994;30(11):1525–1529.
31. Shields GF, Voevoda MI, Ward RH. Phylogenetic relationships and linguistic classification are not correlated among Native Peoples of Beringia. In: “Bridges of Science,” pedological investigations of the late-Pleistocene Bering Land Bridge. Proceedings of the AAAS, Arctic Science Conference. Anchorage/Vladivostok: Arctic Science Conference; 1996. p. 203–209.

32. Derenko M, Malarychuk B, Shields GF. Mitochondrial cytochrome b sequence from a 33000-year-old woolly mammoth (Mammuthus primigenius). Ancient Bio-molecules 1997;1:149–153.

33. Derenko MV, Shields GF. Diversity of mitochondrial DNA nucleotide sequences in three groups of aboriginal inhabitants of Northern Asia. Mol Biol (Mosk) 1997;31(5):784–789.

34. Derenko MV, Shields GF. Polymorphism in region V of mitochondrial DNA in indigenous populations of northern Asia. Genetika 1998;34(3):321–324.

35. Risica PM, Nobmann ED, Caulfield LE, Schraer CD, Ebbesson SO. Springtime macronutrient intake of Alaska Natives of the Bering Straits Region: The Alaska Siberia Project. Int J Circumpolar Health 2003;64(3):222–233.

36. Nobmann ED, Mamleeva FY, Klashkova EVA comparison of the diets of Siberian Chukotka and Alaska Native adults and recommendations for improved nutrition, a survey of selected previous studies. Arctic Med Res 1994;53(3):123–129.

37. Nobmann ED, Mamleeva FR, Rodigina TA. A preliminary comparison of nutrient intakes of Siberian Chukotka and Alaska Natives. In: Postl BD, Gilber P, Goodwill J, et al., editors. Circumpolar Health 90, Proceedings of the 8th International Congress on Circumpolar Health, Whitehorse, Yukon, May 20–25, 1990. Winnipeg: University of Manitoba Press; 1990. p. 752–755.

38. Risica PM, Ebbesson SO, Schraer CD, Nobmann ED, Caballero BH. Body fat distribution in Alaskan Eskimos of the Bering Straits region: the Alaskan Siberia Project. Int J Obes Relat Metab Disord 2000;24(2):171–179.

39. Nobmann ED, Ebbesson SO, White RG, Bulkow LR, Schraer CD. Associations between dietary factors and plasma lipids related to cardiovascular disease among Siberian Yup'iks of Alaska. Int J Circumpolar Health 1999;58(4):254–271.

40. Nobmann ED, Ebbesson SO, White RG, Schraer CD, Lanier AP, Bulkow LR. Dietary intakes among Siberian Yupiks of Alaska and implications for cardiovascular disease. Int J Circumpolar Health 1998;57(1):4–17.

41. Nobmann ED. Diet among Siberian Yup'iks of Alaska and the implications for cardiovascular Disease. [Ph. D. thesis]. Fairbanks: University of Alaska Fairbanks; 1996. 303 p.

42. Danilenko KV, Putilov AA, Russkikh GS, Duffy LK, Barnes BM, Ebbesson SO. Diurnal and seasonal variations of melatonin and serotonin in women with Seasonal Affective Disorder. Arct Med Res 1994;53(3):137–145.

43. Levine ME, Milliron AN, Duffy LK. Diurnal and seasonal rhythms of melatonin, cortisol and testosterone in interior Alaska. Arct Med Res 1994;53(1):25–34.

44. Putilov AA, Danilenko KV, Russkikh GS, Duffy LK. Phase typing of patients with Seasonal Affective Disorder: a test for the phase shift hypothesis. Biol Rhythm Res 1996;27(4):1–21.

45. Levine ME, Duffy LK, Bowyer RT. Fatigue, sleep and seasonal hormone levels: implications for drinking behavior in northern climates. Drugs and Society 1994; (8)(2):61–70.

46. Booker JM, Hellekson CJ, Putilov AA, Danilenko KM. Seasonal depression and sleep disturbances in Alaska and Siberia: a pilot study. Arctic Med Res 1991;Suppl:281–284.

47. Putilov AA, Booker JM, Danilenko KV, Zolotarev DY. The relation of sleep-wake patterns to seasonal depressive behaviour. Arct Med Res 1994;53(3):130–136.

48. Booker JM, Hellekson CJ, Putilov AA. Seasonal depression and sleep disturbances in Alaska and Siberia: a pilot study. In: Postl BD, Gilber P, Goodwill J, et al., editors. Circumpolar Health 90, Proceedings of the 8th International Congress on Circumpolar Health, Whitehorse, Yukon, May 20–25, 1990. Winnipeg: University of Manitoba Press; 1990. p. 281–284.

49. Cheraparova V, Neshumova T, Elsner R. Muscle blood flow in diving mammals. Comp Biochem Physiol Comp Physiol 1993;106(1):1–6.

50. Ebbesson SO, Schraer C, Nobmann ED, Ebbesson LO. Lipoprotein profiles in Alaskan Siberian Yupik Eskimos. Arctic Med Res 1996;55(4):165–173.

51. Schraer CD, Ebbesson SO, Boyko E, Nobmann E, Adler A, Cohen J. Hypertension and diabetes among Siberian Yupik Eskimos of St. Lawrence Island, Alaska. Public Health Rep 1996;111(Suppl 2):51–52.

52. Schraer CD, Risica PM, Ebbesson SO, Go OT, Howard BV, Mayer AM. Low fasting insulin levels in Eskimos compared to American Indians: are Eskimos less insulin resistant? Int J Circumpolar Health 1999;58(4):272–280.

53. Biery AJ, Ebbesson SO, Shuldiner AR, Boyer BB. The β1-adrenergic receptor TRP 64 ARG polymorphism and obesity in Alaskan Eskimos. Int J Obes Relat Metab Disord 1997;21(12):1176–1179.

54. Schraer CD, Ebbesson SO, Adler AI, Cohen JS, Boyko EJ, Nobmann ED. Glucose tolerance and insulin-resistance syndrome among St. Lawrence Island Eskimos. Int J Circumpolar Health 1998;57(Suppl 1):348–354.

55. Nobmann ED, Ebbesson SOE, White RG, Schraer CD, Hankin JH, Lanier AP, et al. Dietary intakes among Siberian Yupik Eskimos and implications for cardiovascular disease. Int J Circumpolar Health 1998;57(1):4–17.

56. Ebbesson SO, Schraer CD, Risica PM, Adler AI, Ebbeson L, Mayer AM, et al. Diabetes and impaired glucose tolerance in three Alaskan Eskimo populations. The Alaska-Siberia Project. Diabetes Care 1998;21(4):563–569.

57. Risica PM, Schraer C, Ebbesson SOE, Nobmann ED, Caballero B. Overweight and obesity among Alaskan Eskimos of the Bering Straits region: the Alaskan Siberia Project. Int J Obes Relat Metab Disord 1997;21(12):1176–1179.

58. Nobmann ED, Ebbesson SOE, White RG, Bulkow LR, Schraer CD. Association between dietary factors and plasma lipids related to cardiovascular disease among Siberian Yupik Eskimos. Int J Circumpolar Health 1999;58(4):254–271.
59. Ebbesson SOE, Kennish J, Ebbesson LOE, Go O, Yeh J. Diabetes is related to fatty acid imbalance in Eskimos. Int J Circumpolar Health 1998;58(2):108–119.

60. Mohanty J, Gilliam LK, Bekris L, Ebbesson SOE, Lernmark A. Type 1 diabetes-related autoantibodies are rare in Alaska Native populations. Int J Circumpolar Health 2002;61(1):21–31.

61. Bjerregaard P, Dewailly E, Young TK, Blanchet C, Hegele RA, Ebbesson SE, et al. Blood pressure among the Inuit (Eskimo) populations in the Arctic. Scand J Public Health 2003;31(2):92–99.

62. Bjerregaard P, Young TK, Dewailly E, Ebbesson SOE. Indigenous health in the Arctic: an overview of the circumpolar Inuit population. Scand J Public Health 2004;32(5):390–395.

63. Ebbesson SOE, Risica PM, Ebbesson LOE, Kennish JM. Eskimos have CHD despite high consumption of omega-3 fatty acids: The Alaska Siberia Project. Int J Circumpolar Health 2005;64(4):387–395.

64. Risica PM, Nebmann ED, Caulfield LE, Schraer C, Ebbesson SOE. Springtime macronutrient intake of Alaska Natives of the Bering Straits region: The Alaska Siberia Project. Int J Circumpolar Health 2005;64(3):222–233.

65. Ebbesson SOE, Adler AI, Risica PM, Ebbesson LOE, Yeh J-L, Go OT, et al. Cardiovascular disease and risk factors in three Alaskan Eskimo populations: The Alaska-Siberia Project. Int J Circumpolar Health 2005;64(4):365–386.

66. Ebbesson SOE, Risica PM, Ebbesson LOE, Kennish JM, Tejero ME. Omega-3 fatty acids improve glucose tolerance and components of the metabolic syndrome in Alaskan Eskimos: The Alaska Siberia Project. Int J Circumpolar Health 2005;64(4):396–408.

67. Ebbesson SOE, Ebbesson LOE, Swenson M, Kennish JM, Robbins DC. A successful diabetes prevention study in Eskimos: The Alaska Siberia Project. Int J Circumpolar Health 2005;64(4):409–424.

68. Young TK, Bjerregaard P, Dewailly E, Risica PM, Jorgensen ME, Ebbesson SOE. Prevalence of obesity and its metabolic correlates among the circumpolar Inuit in 3 countries. Am J Public Health 2007;97(4):691–695.

69. Kaput J, Ordovas JM, Ferguson L, van Ommen B, Rodriguez RL, Allen L, et al. The case for strategic international alliances to harness nutritional genomics for public and person health. Br J Nutr 2005;94(5):623–632.

70. Howard BV, Devereux RB, Cole SA, Davidson M, Dyke B, Ebbesson SOE, et al. A genetic and epidemiologic study of cardiovascular disease in Alaska natives (GOCADAN): design and methods. Int J Circumpolar Health 2005;64(3):206–221.

71. Ebbesson SOE, Laston S, Wenger CR, Dyke B, Romnesoko T, Swenson M, et al. Recruitment and community interactions in the GOCADAN study. Int J Circumpolar Health 2006;65(1):55–64.

72. Voruganti VS, Cai G, Cole SA, Freeland-Graves JH, Laston S, Wenger C, et al. Common set of genes regulates low-density lipoprotein size and obesity-related factors in Alaskan Eskimos: results from the GOCADAN study. Am J Hum Biol 2006;18(4):525–531.

73. Carter EA, MacCluer JW, Dyke B, Howard BV, Devereux RB, Ebbesson SOE, et al. Diabetes mellitus and impaired fasting glucose in Alaska Eskimos: the Genetics of Coronary Artery Disease in Alaska Natives (GOCADAN) study. Diabetologia 2006;49(1):29–35.

74. Smith HS, Bjerregaard P, Chan HM, Corriveau A, Ebbesson SOE, Etzel RA, et al. Research with Arctic Peoples: unique research opportunities in heart, lung, blood and sleep disorders. Working group summary and recommendations. Int J Circumpol Health 2006;65(1):79–90.

75. Zhu J, Davidson M, Leinonen M, Saikkku M, Gaydos CA, Canos DA, et al. Prevalence and persistence of herpes viruses, chlamydia pneumoniae and helicobacter pylori antibodies in Alaska Eskimos: the GOCADAN Study. Clin Microbiol Infect 2006;12(2):118–122.

76. Kaufman DJ, Roman M, Devereux RB, Fabitz R, Gutman K, Dyke B, et al. Prevalence and correlates of smoking and its relationship with carotid atherosclerosis in Alaska Eskimos: the GOCADAN Study. Nicotine Tob Res 2008;10(3):483–491.

77. Ebbesson SOE, Tejero MT, Nebmann ED, Lopez-Alvarenga JC, Ebbesson L, Romnesoko T, et al. Fatty acid consumption and metabolic syndrome components: the GOCADAN study. J Cardiometab Syndr 2007;2(4):244–249.

78. Ebbesson SOE, Roman MJ, Devereux RB, Kaufman D, Fabitz RR, MacCluer JW, et al. Consumption of omega-3 fatty acids is not associated with a reduction in carotid atherosclerosis: the Genetics of Coronary Artery Disease in Alaska Natives study. Atherosclerosis 2008;199(2):346–353.

79. Rivelles AA, Patti L, Kaufman D, Zhu J, Annuzzi G, Vaccaro O, et al. Lipoprotein particle distribution and size, insulin resistance, and metabolic syndrome in Alaska Eskimos: the GOCADAN Study. Atherosclerosis 2008;200(2):350–358.

80. Cutchins A, Roman MJ, Devereux RB, Ebbesson SO, Ijmans JG, Zhu J, et al. Prevalence and correlates of subclinical atherosclerosis in Alaska Eskimos: the GOCADAN study. Stroke 2008;39(11):3079–3082.

81. Howard, BV, Best L, Comuzzie A, Ebbesson OE, Epstein SE, Fabitz RR, et al. C-reactive protein, insulin resistance, and metabolic syndrome in a population with a high burden of subclinical infection: insights from the Genetics of Coronary Artery Disease in Alaska Natives (GOCADAN) study. Diabetes Care 2008;31(12):2312–2314.

82. Ebbesson SOE, Tejero ME, Lopez-Alvarenga JC, Harris WS, Ebbesson LO, Devereux RB, et al. Individual saturated fatty acids are associated with different components of insulin resistance and glucose metabolism: the GOCADAN Study. Int J Circumpolar Health 2010;69(4):344–351.

83. Ebbesson SOE, Devereux RB, Cole S, Ebbesson LO, Fabitz RR, Haack K, et al. Heart rate is associated with red blood cell fatty acid concentration: the Genetics of Coronary Artery Disease in Alaska Natives (GOCADAN) study. Am Heart J 2010;159(6):1020–1025.

84. Ebbesson SOE, Lopez-Alvarenga JC, Okin PM, et al. Heart rate is associated with markers of fatty acid desaturation: the GOCADAN study. Int J Circumpolar Health 2011 [in press].
85. Scott EM, Griffith IV. Diabetes mellitus in Eskimos. Metabolism 1957;6(4):320–325.
86. Maynard JE, Hammes LM, Kester FE. Mortality due to heart disease among Alaskan Natives, 1955–65. Public Health Rep 1967;82(8):714–720.
87. Wessby B, Åro A, Skarfoes E, Berglund L, Salminen I, Lithell H. The risk to develop NIDDM is related to the fatty acid composition of the serum cholesterol esters. Diabetes 1994;43(11):1353–1357.
88. Bang HO, Dyerberg J, Sinclair HM. The composition of the Eskimo food in north western Greenland. Am J Clin Nutr 1980;33(12):2657–2661.
89. Warensjö E, Sundström J, Wessby B, Cederholm T, Risérus U. Markers of dietary fat quality and fatty acid desaturation as predictors of total and cardiovascular mortality: a population-based prospective study. Am J Clin Nutr 2008;88(1):203–209.
90. Leaaf A, Kang JX, Xiao YF, Billman GE. Clinical prevention of sudden cardiac death by n-3 polyunsaturated fatty acids and mechanism of prevention of arrhythmias by n-3 fish oils. Circulation 2003;107(21):2646–2652.
91. Thies F, Garry JM, Yaqoob P, Rerkasem K, Williams J, Shearman CP, et al. Association of n-3 polyunsaturated fatty acids with stability of atherosclerotic plaques: a randomized controlled trial. Lancet 2003;361(9356):477–485.
92. Schumacher C, Davidson M, Ehrsam G. Cardiovascular disease among Alaska Natives: a review of the literature. Int J Circumpolar Health 2003;62(4):343–362.
93. Trimble B, Hamel R, Gorelick P, Horner R, Longstreth W. Alaska Native stroke registry. Int J Stroke 2007;2(1):60–61.

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**Appendix 1. Guide for prevention of diabetes and heart disease**

NSHC CAMP Department

**EAT HEALTHIER FOODS INSTEAD OF FATTY, SUGARY FOODS**

| INSTEAD OF THESE:                           | EAT MORE OF THESE:                          |
|-------------------------------------------|--------------------------------------------|
| **Non-Traditional meats like:**           | **Traditional meats like:**                |
| Beef (Cut away fats)                      | Fish                                       |
| Pork (Cut away fats)                      | Walrus and Seal                            |
| *(Beef and pork are much higher in saturated [bad] fats that contribute to heart disease, stroke, and diabetes.)* | Whale                                      |
| Spam                                      | Reindeer, Caribou and Moose               |
| Bacon                                     | Skinless Chicken and Birds                |
| Crisco and Butter                         | Seal Oil                                   |
| Bacon grease                              | Whale Oil                                  |
| Oil-Packed Tuna                           | Olive and Canola Oil                      |
| High-Fat Lunch Meats                      | Water-Packed Tuna                          |
| Regular Hot Dogs                          | Low-Fat Lunch Meats                       |
| Cheddar or American Cheese                | Turkey Hot Dogs/Low-Fat Hot Dogs          |
| Whole Milk                                | Mozzarella Cheese                         |
| Coffee Creamer                            | Skim Milk                                  |
| Regular Mayonnaise                        | Evaporated Skim Milk                       |
| Sugary Cereal                             | Low-Fat, Low-Sugar Coffee Creamer          |
| White Bread                               | Light Mayonnaise                           |
| Greasy Crackers                           |                                            |
| Greasy Snack Foods                        |                                            |
| Cookies                                   |                                            |
| Candy                                     |                                            |
| Chips                                     |                                            |
| Ice Cream                                 |                                            |
| Soda                                      |                                            |
| Sugary Juice (Tang, Kool-Aid, Capri Sun, etc.) |                                            |

*Some foods say they are made from whole grains but may not necessarily have the benefits whole grains give. Look to see that the first ingredient is WHOLE GRAIN, and try to get at least 3 grams of fiber in whole-grain products.*