The Impact of Telehealth on Wait Time for ENT Specialty Care

Philip J. Hofstetter, Au.D.,[1] John Kokesh, M.D.,[2] A. Stewart Ferguson, Ph.D.,[3] and Linda J. Hood, Ph.D.[4]

[1]*Audiology Department, Norton Sound Health Corporation, Nome, Alaska.*
[2]*Department of Otolarnygology, Alaska Native Medical Center, Anchorage, Alaska.*
[3]*AFHCAN Telehealth Program, Alaska Native Tribal Health Consortium, Anchorage, Alaska.*
[4]*Department of Hearing and Speech Sciences, Vanderbilt University, Nashville, Tennessee.*

Abstract

Audiology in rural Alaska has changed dramatically in the past 6 years by integrating store and forward telemedicine into routine practice. The Audiology Department at the Norton Sound Health Corporation in rural Nome Alaska has used store-and-forward telemedicine since 2002. Between 2002 and 2007, over 3,000 direct audiology consultations with the Ear, Nose, and Throat (ENT) Department at the Alaska Native Medical Center in Anchorage were completed. This study is a 16-year retrospective analysis of ENT specialty clinic wait times on all new patient referrals made by the Norton Sound Health Corporation providers before (1992–2001) and after the initiation of telemedicine (2002–2007). Prior to use of telemedicine by audiology and ENT, 47% of new patient referrals would wait 5 months or longer to obtain an in-person ENT appointment; this dropped to 8% of all patients in the first 3 years with telemedicine and then less than 3% of all patients in next 3 years using telemedicine. The average wait time during the first 3 years using telemedicine was 2.9 months, a 31% drop compared with the average wait time of 4.2 months for the preceding years without telemedicine. The wait time then dropped to an average of 2.1 months during the next 3 years of telemedicine, a further drop of 28% compared with the first 3 years of telemedicine usage.

Key words: *telehealth, telemedicine, teleaudiology, audiology, ENT, otoscopy, extreme environments*

Introduction

Telehealth is fast becoming recognized as a method to improve healthcare in developing nations, regions of low population density, and areas with limited access to both primary care providers and specialists.[1–4] The lack of providers or access to specialists in rural regions is well documented.[5,6] The World Health Organization (2008)[7] reports that there are currently 26 physicians per 10,000 Americans in general, with a drop to less than 10 physicians per 10,000 Americans specifically in rural Alaska.[8]

This ratio becomes worse for specialty providers. For example, there are less than five audiologists or otolaryngologists per 10,000 people in Alaska. Rural regions traditionally have poor provider–patient ratios that add to the already difficult access to healthcare for persons in these areas. Retention of providers, regardless of rural or nonrural location, has been shown to break down when provider networks and specialty referral processes are lacking.[6] Studies have long linked socioeconomic status with poor and dissatisfying healthcare.[9–11]

Impoverished rural patients and patients of Alaska Native/American Indian ethnicity are reported as the least satisfied with their healthcare.[10] Increased demand for healthcare and low provider–patient ratios, particularly in the rural regions with low socioeconomic status, have led to long wait times for care. Limited access to healthcare and lack of availability of appointments distress patients.[12] Providers are overwhelmed with demands for clinic appointments, which may need to be booked weeks, or sometimes months, in advance. Although open access models have helped to improve wait times in some healthcare organizations, access and wait time problems continue to be prevalent.

Delivering quality healthcare in Alaska, with a population of 636,932 (U.S. Census, 2000)[13] in 586,412 miles, is challenging. The population is very dispersed with a density of 1.1 persons per square

mile. Seventy-five percent of the state is not connected to a road system and patients in these regions must rely on the often dangerous small plane travel to reach specialty appointments in rural hubs. The National Travel and Safety Board (NTSB) reported 436 commuter aircraft accidents in 1990–2004 in Alaska. This is equivalent to 2.8 accidents a month and accounts for 36% of all commuter aircraft accidents in the United States (www.ntsb.gov).[14] Travel to even more distant locations is required for access to fully equipped hospitals in a large city, such as Anchorage.

This study is a retrospective analysis of the use of audiology-to-ENT (Ear, Nose, and Throat) store-and-forward telemedicine consultations in rural Alaska. In this case the consulting provider is an ENT specialist at the Alaska Native Medical Center (ANMC) in Anchorage and the initiating provider is an audiologist at Norton Sound Health Corporation (NSHC) serving Nome and its surrounding 15 villages. Audiologists typically diagnose and rehabilitate patients with ear, hearing, and vestibular disorders, whereas patients requiring medical treatments or surgery (i.e., ear tubes) are referred to ENT. The audiologist is likely the best equipped to provide accurate referrals to an ENT. The ANMC Department of Otolaryngology in Anchorage is the closest specialty care access for these patients. ANMC is a tribally owned and operated hospital that services 130,000 Alaskan Natives and provides otolaryngology (ENT) coverage for most of the state, including the Norton Sound region. The NSHC in Nome, Alaska, is an Indian Health Service hospital that services 15 surrounding native villages with a population of ~10,000 people spread over 20,000 square miles. The NSHC Audiology Department consists of two audiologists providing services to over 2,000 patients a year. NSHC audiologists travel via small aircraft up to 23 times a year to provide 3–4-day clinics in the surrounding villages. These services include basic diagnostics, hearing aid fitting, cochlear implant mapping, vestibular assessments, auditory processing evaluations, auditory evoked potentials, and telemedicine. Approximately 35% of audiology patients have a medical need that requires an ENT consultation related to chronic dysfunctions of the Eustachian tube (e.g., otitis media, tympanic membrane perforations).

Telemedicine and audiology equipment was established and provided by the Alaska Federal Healthcare Access Network to NSHC. AFHCAN is a statewide program that provides telehealth solutions to clinics and hospitals throughout Alaska since 1999.[16] Store-and-forward technology allows an image, video clip, scanned documents, or specific test results to be captured in electronic format and then forwarded on to a provider. A unit resides in each village clinic within the NSHC region, operates via satellite feed, and can communicate point to point between each site. The parameters of interaction are established within NSHC and ANMC. NSHC manages and maintains the electronic health record, and the NSHC Audiology Department manages patient records. A telemedicine case typically included patient demographics, clinical data, images, and results from diagnostic tests. Cases were created for ENT issues by NSHC providers that included audiologists, physicians, public health nurses, dentists, physician assistants, and staff of the infant learning program. These cases were transmitted to ENT specialists at ANMC, who then provided a response to the initiating provider.

The goal of this study was to determine the relationship between use of telemedicine consultations and changes in patient wait times, access to care, and travel-related costs.

Methods

All 1,690 new referrals to the ENT clinic by NSHC providers from 1992 to 2007 were assessed. A new referral is described as a patient not previously seen by ANMC ENT, but for whom the opinion or care of the ENT specialist was requested.

The difference in time from the date of the referral and the scheduled ENT clinic appointment was measured: this is the wait time for that patient. The time was rounded up to the closest integer value (in months). Patients referrals were considered to be "pre-telemedicine" if the date of referral occurred prior to December 2001, after which telemedicine was introduced and routinely used in the referral process. The location of the patient at the time of the referral was documented for later calculations of travel costs.

The cost analysis was simplified to focus on airfare because it is the variable that is most easily quantified and most accurate. Travel was only calculated for patients living in villages outside Nome, using the average village travel ticket cost for each year. Travel for escorts was included for all children under the age of 18 and elders who required assistance.

Results

The average and median wait times for patients to see an ENT specialist "in person" are shown in *Figure 1*. Although there is variability in the waiting time pre-telemedicine (1992–2001), there was a continual drop in the average waiting time after telemedicine was introduced beginning in 2002. The average annual wait time prior to telemedicine was 4.2 months, with a range of 3.7 months (in 1996) to 5.3 months (in 1993). The average wait time fell to 2.5 months during the 6 years in which telemedicine was used, with a range of 1.7 months (in 2007) to 3.0 months (in 2003).

During the first year when telemedicine was introduced the average wait time fell to 2.7 months, which represented a 40%

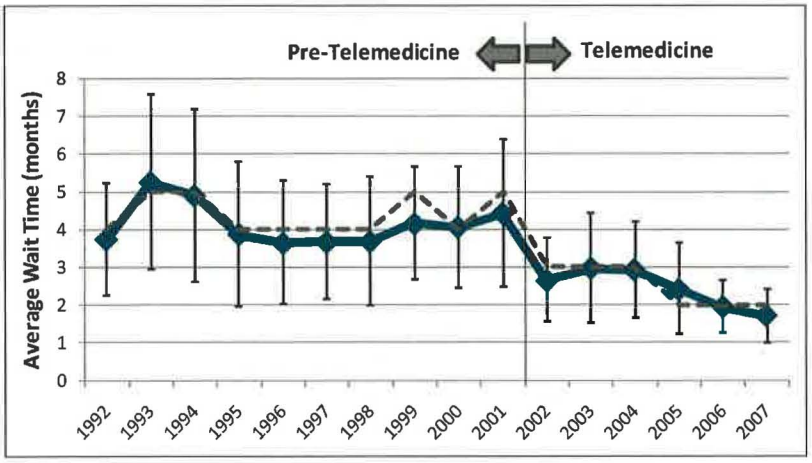

Fig. 1. Average wait time (solid line with diamond markers) from 1992 to 2007 for new referrals to ENT (Ear, Nose, and Throat) specialty clinics by Norton Sound Health Corporation (NSHC) providers. Pre-telemedicine years span 1992–2001, after which telemedicine was introduced from 2002 to 2007. The error bars indicate ±1 standard deviation. The dashed line indicates the median wait time in each year, which closely parallels the average wait time.

reduction from the 4.4-month average wait time in the preceding year without telemedicine. Other than a slight increase to an average wait of 3 months in 2003, the average wait time declined each year telemedicine was employed. The correlation coefficient for the wait times during the telemedicine years ($r^2 = 0.73$) provides strong evidence for a linear relationship in the reduction of telehealth during these years, with an average reduction in waiting time of 0.24 months per year when telemedicine was used. By contrast, the weak correlation coefficient ($r^2 = 0.04$) during the 10 years pre-telemedicine supports the premise that wait times were not changing as a function of time prior to telemedicine but, in fact, remained nearly constant.

A general trend of reduction in the standard deviation was also observed before and after telemedicine was introduced. In fact, the least amount of variability in pre-telemedicine years—as evidenced by the standard deviation in wait times (1.5 months in 1992)—matched with the greatest variability during telemedicine (1.5 months in 2003). Otherwise, variability evidenced by the standard deviation in wait times was always higher during the pre-telemedicine years, reaching as high as 2.3 months in 1993. By comparison, the variability was always less when using telemedicine, dropping as low as 0.7 months in 2006.

The median wait time, shown in *Figure 1*, represents the wait time in each year for which 50% of the patients waited a longer time and 50% waited less time. In general, the median time closely followed the average time as might be expected for "well-distributed" data with minimal outliers. Interestingly, the median time stepped down to 3 months and remained at this value for the first 3 years with telemedicine and then stepped further down to 2 months for the subsequent 3 years. This implies that wait times for the 6 telemedicine years may have different distributions, as the median and average times follow different paths. A two-tailed *t*-test for unequal variances supported the hypothesis that the mean wait time during the pre-telemedicine years was significantly different compared with the mean wait time with telemedicine ($p < 0.001$). There was also a significant difference in the mean wait time between the first 3-year period (2002–2004) and second 3-year period (2005–2007) using telemedicine ($p < 0.001$). There was no significant difference between the first 5 years pre-telemedicine (1992–1996) and the second 5-year period pre-telemedicine (1997–2001) ($p < 0.001$).

The distribution of wait times is shown in *Figure 2* for the pre-telemedicine years and the telemedicine years—the latter being split into two periods of 3 years each. Overall, there was a shift in waiting times to lower values as telemedicine was adopted. The peak of the distribution curve (or the waiting period with the greatest number of patients) lay at 5 months for the 10 years prior to telemedicine, then shifted to 3–4 months during the first 3 years with telemedicine, and eventually dropped to 2 months in the next 3 years of telemedicine usage.

The average wait time during the first 3 years using telemedicine was 2.9 months, a 31% drop compared with the average wait time of 4.2 months for the preceding years without telemedicine. The wait time then dropped to an average of 2.1 months during the next 3 years of telemedicine, a further drop of 28% compared with the first 3 years of telemedicine usage.

Prior to telemedicine, less than 13% of pre-telemedicine new patient referrals were able to obtain an appointment within the first month (*Fig. 3*), and only 35% were able to obtain an appointment within 3 months. By contrast, during the most recent 3 years with telemedicine, 31% of all new patient referrals were able to obtain an appointment within the first month, 73% within 2 months, and 92% within 3 months.

Discussion

Average waiting time to see a specialist decreased dramatically with the introduction of telemedicine at NSHC in 2002. The average

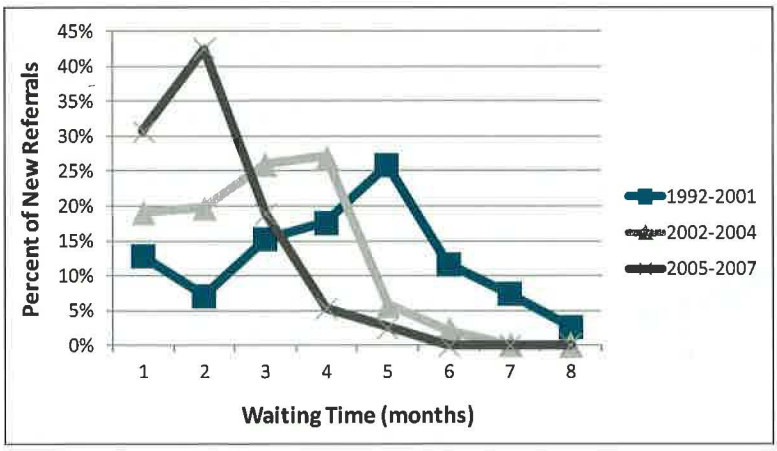

Fig. 2. Distribution of average wait times for new referrals to ENT clinic by NSHC providers for the pre-telemedicine years (1992–2001, square markers), the first 3 years with telemedicine (2002–2004, triangle markers), and the next 3 years of telemedicine usage (2005–2007, "X" markers).

wait time dropped by 50% over the 6 years of telemedicine usage. The reduction in wait time did not happen immediately but rather occurred in a linear manner over a 6-year period, eventually reaching an average wait time of 1.7 months after 6 years of telemedicine. This is close to the theoretical limit on waiting times, as ENT clinics occur every 2–3 months, which means the average wait time would be 1–1.5 months even under ideal conditions. Telemedicine also created a situation in which 92% of new referrals are seen by an ENT specialist within 3 months, which means that a new patient could now be seen in the very next clinic.

It is possible to attain a drop in wait time through other mechanisms such as increasing the availability of in-person specialty appointments. This was not the case for this study. The total number of available ENT specialty clinic appointments from 1992 to 2007 is shown in *Figure 4*. With the exception of 2007, most years show a relatively stable number of available appointment slots. In 2007, the amount of clinic days were reduced as a result of decreased specialty provider's availability. Overall, there was a significant reduction in wait times that cannot be explained by changes in supply of in-person appointments, and in fact, for 2007 the supply was the lowest while the wait time was most reduced.

The reduction in wait times occurs because patients can receive the equivalent of an in-person visit via telehealth. At the onset of the telemedicine program the following question was posed: Would telemedicine only reduce the initial backlog of the patient waiting list and then stabilize? The steady increase in number of cases and progressive reduction in wait time compared to pre-telemedicine values certainly suggest that telemedicine has affected more than just the initial backlog of patients. The recurring need for ENT access and the ability of audiology telemedicine to fulfill much of that need has led to the increase in its use. The consults directly or indirectly can free up space on the ENT specialty clinic and therefore reduce the overall wait time.

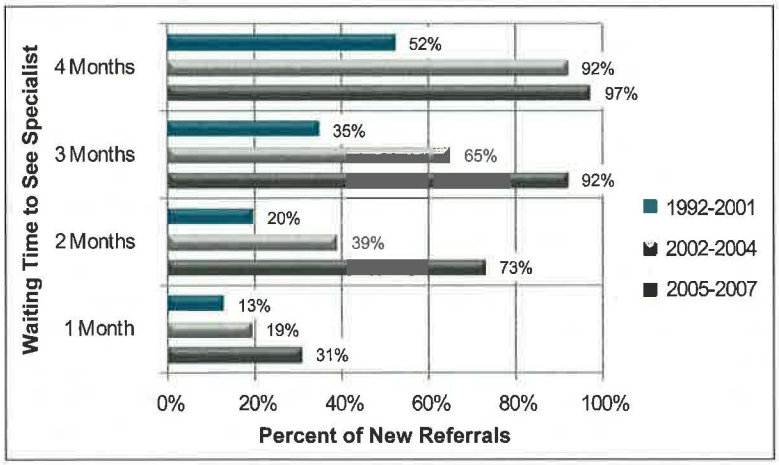

Fig. 3. Percent of new referrals seen within 1–4 months during pre-telemedicine years (1992–2001) and two telemedicine periods (2002–2004, 2005–2007). During the most recent telemedicine period (2005–2007), almost all new referrals (92%) were seen by a specialist within 3 months compared with only a third (35%) of all new referrals prior to the introduction of telemedicine.

Telemedicine now allows patients and providers to receive an ENT response within 24 h as opposed to waiting for the input from the specialist at the next scheduled clinic. Diagnostic audiology tests and high-resolution tympanic membrane images sent via telemedicine to an ENT specialist are highly effective in the management of those patients with ear pathologies. The ENT specialist determines direct treatment, surgical referrals, or recurring telemedicine follow-up. If there is any concern of a misdiagnosis, the patient can be directly referred to an ENT clinic. However, audiology clinics occur on a more frequent basis, which allow close monitoring of patients through telemedicine. NSHC Audiology employs telemedicine for new referrals and established patients, conducting 3,042 consultations

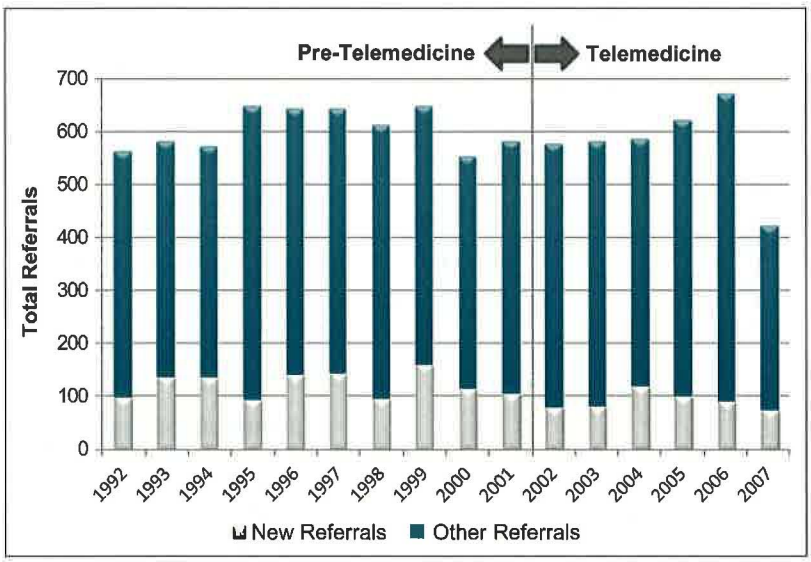

Fig. 4. Available ENT appointments at NSHC specialty clinic per year from 1992 to 2007. There was a high of 647 appointments pre-telemedicine (1999) compared with a high of 670 during telemedicine (2006). There was a low of 560 pre-telemedicine (1992) and 420 during telemedicine (2007).

with ANMC ENT between 2002 and 2007. By eliminating the need for a face-to-face encounter with the specialist, the use of telemedicine for these cases reduced the number of referrals from the ENT specialty clinics by over 95%. This point is critical as the reduction of the ENT clinic backlog may have made room for other provider referrals.

The use of store-and-forward consultations now obviates the need for an in-person ENT specialty exam for 89% of new patients. Round trip airfare costs from Nome to surrounding villages reach $300–400 per patient. Annual cost savings alone, from the prevention of in-person appointments, now reach $250,000 (using 2007 data with 736 telehealth consults). Other related cost savings are difficult to quantify for aspects such as prevented time away from work, lodging, convenience, early diagnosis, and efficacious healthcare. Quantifying these variables and including all factors in a cost comparison is what makes cost analysis difficult. In this study, only cost savings by travel was assessed. Further, the social costs cannot be factored as easily, such as the time away from family and the dangerous flying conditions to which patients are exposed. For example, six people were flying in a twin engine propeller aircraft on February 20, 2009 (some for hospital appointments in Nome) that crashed on a mountain side 6 miles outside of Nome (NTSB Website, 2009). They survived, but how can one quantify the emotional cost of that experience? What about the emotional cost on future flights?

Conclusions

There are many factors (e.g., patient perception, staff turnover, provider experience) that make it remarkably difficult to prove improved quality within a healthcare system.[14] Access to care is one important factor that affects the quality and satisfaction within a healthcare system. The data presented in this study demonstrate that the introduction of telemedicine to NSHC Audiology in 2002 has reduced the time it takes for a new patient to be scheduled.

Disclosure Statement

No competing financial interests exist.

REFERENCES

1. Mora F, Cone S, Rodas E, Merrell RC. Telemedicine and electronic health information for clinical continuity in a mobile surgery program. *World J Surg* **2006**;30:1128–1134.
2. Battye KM, McTaggart. Development of a model for sustainable delivery of outreach allied health services to remote northwest Queensland, Australia. *Rural Remote Health* **2003**;3(194). Available at http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=194 (last accessed May 4, 2010).
3. Hailey D, Foerster V, Nakagawa B, Wapshall TM, Murtagh JA, Smitten J. Achievements and challenges on policies for allied health professionals who use telehealth in the Canadian Arctic. *J Telemed Telecare* **2005**;11(Suppl 2): S39–S41.
4. Kokesh J, Ferguson AS, Patricoski C. Telehealth in Alaska: Delivery of health care services from a specialist's perspective. *Int J Circumpolar Health* **2005**;63: 387–400.
5. Fisher DG, Pearce FW, Statz DJ, Wood MM. Employment retention of health care providers in frontier areas of Alaska. *Int J Circumpolar Health* **2003**;62:423–435.
6. Brodsky K. *Best practices in specialty provider recruitment and retention: Challenges and solutions. The commonwealth fund*, Volume 6. **2005**. Available at http://www.commonwealthfund.org/Content/Publications/Fund-Reports/2005/Aug/Best-Practices-in-Specialty-Provider-Recruitment-and-Retention–Challenges-and-Solutions.aspx (last accessed May 4, 2010).
7. WHO [World Health Organization]. The World Health Report 2008: Primary Health Care Now More Than Ever. **2008**.
8. Alaska State Medical Association. Physician Directory 2009.
9. Lynch J, Kaplan G, Salonen R, Salonen JT. Socioeconomic status and progression of carotid atherosclerosis. *Arterioscler Thromb Vasc Biol* **1997**;17:513–519.

10. Haviland M, Morales L, Dial T, Pincus HA. Race/ethnicity, socioeconomic status, and satisfaction with health care. *Am J Med Qual* **2005;**20:195–203.

11. Becker G and Newsom E. Socioeconomic status and dissatisfaction with healthcare among chronically ill African-Americans. *Am J Public Health* **2003;**93:742–748.

12. Kilo CM, Trieffletti P, Tantau C, Murray M. Improving access to clinical offices. *J Med Pract Manage* **2000;**16:126–132.

13. U.S. Census Bureau. Alaska Quickfacts. Available at http://quickfacts.census.gov (last accessed February 16, 2009).

14. National Travel and Safety Board (NTSB). Alaska commuter aircraft accident report 1990–2004. [This report is no longer available from the NTSB Web site (www.ntsb.gov) but is mentioned on the Alaska Aviation Safety Project Web site (www.ak-aasp.org/Documentation; last accessed May 4, 2010)].

15. National Travel and Safety Board (NTSB). February 20, 2009 Preliminary report, Nome, Alaska. Available at www.ntsb.gov/ntsb/brief.asp?ev_id=20090220x43946&ntsbno=ANC09LA021&akey=1 (last accessed May 4, 2010).

16. Ferguson AS. Enterprise store-and-forward telemedicine: Connecting multiple networks and multiple servers." *Abstract presented at the Annual Conference of the American Telemedicine Association*, Ft. Lauderdale, FL. **2003.**

17. Rubenstein LV, Hempel S, Farmer MM, Asch SM, Yano EM, Dougherty D, Shekelle PW. Finding order in heterogeneity: Types of quality-improvement intervention publications. Qual Saf Health Care **2008;** 17:403–408.

Address correspondence to:
A. Stewart Ferguson, Ph.D.
AFHCAN Telehealth Program
Alaska Native Tribal Health Consortium
4000 Ambassador Drive, Rm. 332
Anchorage, AK 99508

E-mail: sferguson@anthc.org

Received: October 9, 2009
Revised: November 6, 2009
Accepted: November 6, 2009