Rural Telemedicine and Telehealth: The Alaskan Experience

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Alaska: Context

- **Largest state: 1,481,346 sq. km.**
- **Population: >710,000**
- **Lowest population density:**
  - **< .5 persons per sq. km.**
- **Half population in Anchorage**

- **Alaska natives: 14.8% of population**
- **6 major linguistic/cultural groups, 226 tribes**
- **2/3 live in more than 200 villages**
- **Very limited road system**
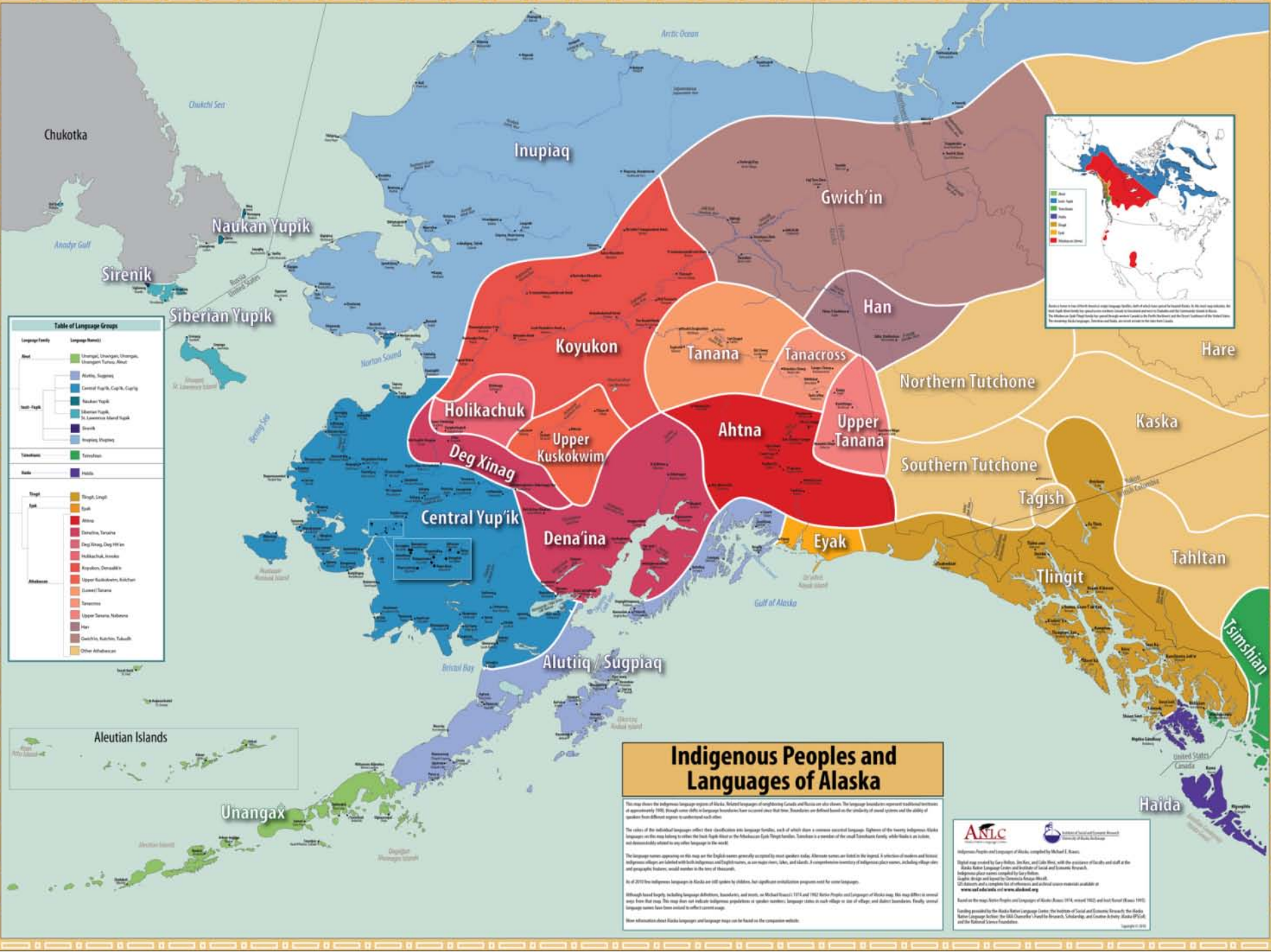- **Many villages accessible only by boat or bush plane**

ARCTIC OCEAN

CHUKCHI SEA

GULF OF ANADYR

CHUKOTK

RUSSIA
UNITED STATES

Wainwright • Barrow

Point Hope

FAR NORTH

Deadhorse • Prudhoe Bay

BEAUFORT SEA

Colville River

Umiat

Noatak

ARCTIC NATIONAL WILDLIFE REFUGE

Uelen
Lavrentiya
Little Diomede
Shishmaref
Wales

Kotzebue

Noorvik
Selawik

Noatak River

GATES OF THE ARCTIC NAT'L PARK & PRESERVE

Anaktuvuk Pass

BROOKS RANGE

Arctic Village

U.S.A. / CANADA YUKON

Providenyia

Teller
Taylor

ARCTIC CIRCLE

Bettles
Coldfoot

Gambell

Pilgrim Springs

Nome

Council
White Mountain

Huslia

Fort Yukon

ST. LAWRENCE ISLAND

Savoonga

Nulato

Galena

Stevens Village

Tanana
Manley Hot Springs
Rampart

Central
Circle

Emmonak
St. Michael

INTERIOR

Chena Hot Springs

Fairbanks

YUKON-CHARLEY RIVERS NAT'L PRESERVE

ST. MATTHEW ISLAND

Scammon Bay

Hooper Bay • Saint Marys

Holy Cross

Yukon R.

Nenana
North Pole

Eagle

DENALI NAT'L PARK & PRESERVE

Kantishna
MT. McKINLEY

Healy

Delta Jct.

Chicken
Boundary

Mekoryuk
NUNIVAK ISLAND

Bethel

Amak

McGrath

Dawson City

BERING SEA

PRIBILOF ISLANDS
ST. PAUL ISLAND

SOUTHWEST

Kuskokwim River

KUSKOKWIM MTNS

Cantwell

Paxson

Tok

Northway

ALASKA RANGE

Talkeetna

Lake Louise

Gakona Jct.
Glennallen

Nabesna • Beaver Creek

ST. GEORGE ISLAND

Quinhagak

Wood-Tikchik System

LK. CLARK NAT'L PARK & PRESERVE

Willow
Houston
Big Lake

Wasilla Sutton

Copper Center

Chitina

Carmacks

Ross River

Goodnews Bay
TOGIAK NAT'L WILDLIFE REFUGE

Dillingham

Nushagak River

Iliamna
Lake Clark

Anchorage
Palmer
CHUGACH MTNS.

Kennicott

N.W. TERRITORY YUKON

Kenai
Soldotna
Whittier

McCarthy

Klaane Lake

Iliamna Lake

Naknek

Ninilchik
Anchor Pt.
Homer
Soldovia

Seward

Valdez
PRINCE WILLIAM SOUND
Cordova

Destruction Bay
KLUANE NAT'L PARK

Haines Junction

Whitehorse

King Salmon

KATMAI NAT'L PARK & PRESERVE

COOK INLET

KENAI FJORDS NAT'L PARK

WRANGELL-ST. ELIAS NAT'L PARK & PRESERVE

Lake Laberge

Carcross

Watson Lake

BRITISH COLUMBIA

ALEUTIAN ISLANDS

KISKA ISLAND

ANIAKCHAK NAT'L MONUMENT & PRESERVE

Port Lions
Kodiak

Yakutat

White Pass Summit

Haines
Skagway

SOUTHCENTRAL

Dutch Harbor
Akutan
Unalaska

False Pass
King Cove
Cold Bay

Chignik

Sand Point

KODIAK ISLAND
Old Harbor

KODIAK NATIONAL WILDLIFE REFUGE

GULF OF ALASKA

GLACIER BAY NAT'L PARK & PRESERVE

Auke Bay

Gustavus
Elfin Cove
Pelican
Tenakee

Juneau

Hoonah Tracy Arm

Angoon

Stikine River

PACIFIC OCEAN

INSIDE PASSAGE

Sitka

Kake

Petersburg

Wrangell

Hyder Stewart

MISTY FIORDS NAT'L MONUMENT WILDERNESS

Hollis
Ketchikan

Metlakatla

Prince Rupert

Indigenous Peoples and Languages of Alaska

Table of Language Groups

Language Family	Language Name(s)
Aleut	Unangax, Unangan, Unangas, Unangam Tunuu, Aleut
Yup'ik–Inuit	Alutiiq, Sugpiaq
	Central Yup'ik, Cup'ik, Cup'ig
	Naukan Yupik
	Siberian Yupik, St. Lawrence Island Yupik
	Sirenik
	Inupiaq, Iñupiaq
Tsimshianic	Tsimshian
Haida	Haida
Tlingit	Tlingit, Lingít
Eyak	Eyak
Athabascan	Ahtna
	Dena'ina, Tanaina
	Deg Xinag, Deg Hit'an
	Holikachuk, Innoko
	Koyukon, Denaakk'e
	Upper Kuskokwim, Kolchan
	(Lower) Tanana
	Tanacross
	Upper Tanana, Nabesna
	Han
	Gwich'in, Kutchin, Tukudh
	Other Athabascan

Region and language labels

Chukotka
Chukchi Sea
Anadyr Gulf
Naukan Yupik
Sirenik
Siberian Yupik
Bering Sea
Norton Sound
Inupiaq
Koyukon
Holikachuk
Deg Xinag
Upper Kuskokwim
Central Yup'ik
Dena'ina
Alutiiq / Sugpiaq
Bristol Bay
Aleutian Islands
Unangax
Tanana
Ahtna
Gwich'in
Han
Tanacross
Upper Tanana
Eyak
Northern Tutchone
Southern Tutchone
Tagish
Tlingit
Kaska
Tahltan
Hare
Tsimshian
Haida
Gulf of Alaska
Arctic Ocean
Russia / United States
United States / Canada

ANLC — Alaska Native Language Center
Institute of Social and Economic Research, University of Alaska Anchorage

Indigenous Peoples and Languages of Alaska, compiled by Michael E. Krauss.

Digital map created by Gary Holton, Jim Kari, and Colin West, with the assistance of faculty and staff at the Alaska Native Language Center and Institute of Social and Economic Research.
Indigenous place names compiled by Gary Holton.
Graphic design and layout by Clemencia Amaya Merrill.
GIS datasets and a complete list of references and archival source materials available at www.uaf.edu/anla and www.alaskool.org

Based on the maps Native Peoples and Languages of Alaska (Krauss 1974, revised 1982) and Inuit Nunaat (Krauss 1995).

Funding provided by the Alaska Native Language Center, the Institute of Social and Economic Research, the Alaska Native Language Archive, the UAA Chancellor's Fund for Research, Scholarship, and Creative Activity, Alaska EPSCoR, and the National Science Foundation.

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Alaska Native Claims Settlement Act (ANCSA)

Alaska Native Regional Corporations

- **No treaties or reservations**
- **ANCSA became law in 1971**
- **Settled land claims before construction of oil pipeline**
- **Received 44 million acres and $962.5 million**
- **13 Native Corporations**
  - **Nonprofit affiliates administer health services**
- **Also more than 200 village corporations**

Alaska: Challenges in Rural Education and Health Care Delivery

- **Shortage of professionals**
  - **teachers, physicians**
- **Distance from specialized expertise**
  - **medical specialists**
  - **teachers of specialized and advanced subjects**
- **Problems exacerbated by poverty and isolation**
- **Lowest population density in U.S.**
  - **Only 4 communities over 10,000**
  - **Isolated villages and small towns**
    - **More than 200 villages**
    - **Many villages accessible only by boat or bush plane**
    - **Most of village population is native American**

ALASKA's PHYSICIANS

- **Shortage of physicians**

- **Distance from specialized expertise**
  - **medical specialists**

- **Problems exacerbated by poverty and isolation**

- **49% of all physicians in Alaska are primary care physicians**
  - **U.S. average is 28%**

- **Alaska is 48th of states in "doctors to residents" ratio**
  - **65% are located in Anchorage**
  - **Shortages in many specialties**

- **59% of the state's residents are in medically underserved areas.**

Historically, Alaskan health care has incorporated a public health mission and primary care focus, and is less reliant on specialty acute care than other parts of the country.

Early Telemedicine…

"We went from house to house taking care of the sick… Our tools consisted of a thermometer, a stethoscope, and a blood pressure cuff…. We had no phones… but used the school's [HF] radio to report [on] our patients. There was no nonsense about confidentiality."

-- Health aide Paula Ayunerak

Early Experiments: NASA ATS-1 Satellite Single Channel Voice Network

1971-1976: led to satellite communications for all rural clinics and reliable communications for all villages

ALASKA LOCATIONS WITH ATS-1 GROUND STATIONS

1	Allakaket
2	Anaktuvuk Pass
3	Anchorage
4	Arctic Village
5	Barrow
6	Beaver
7	Bethel
8	Chalkyitsik
9	Eagle
10	Fairbanks
11	Fort Yukon
12	Galena
13	Hughes
14	Huslia
15	Juneau
16	Kodiak
17	Kotzebue
18	Koyukuk
19	Nome
20	Nulato
21	Ruby
22	St. Paul
23	Stevens Village
24	Tanana
25	Venetie
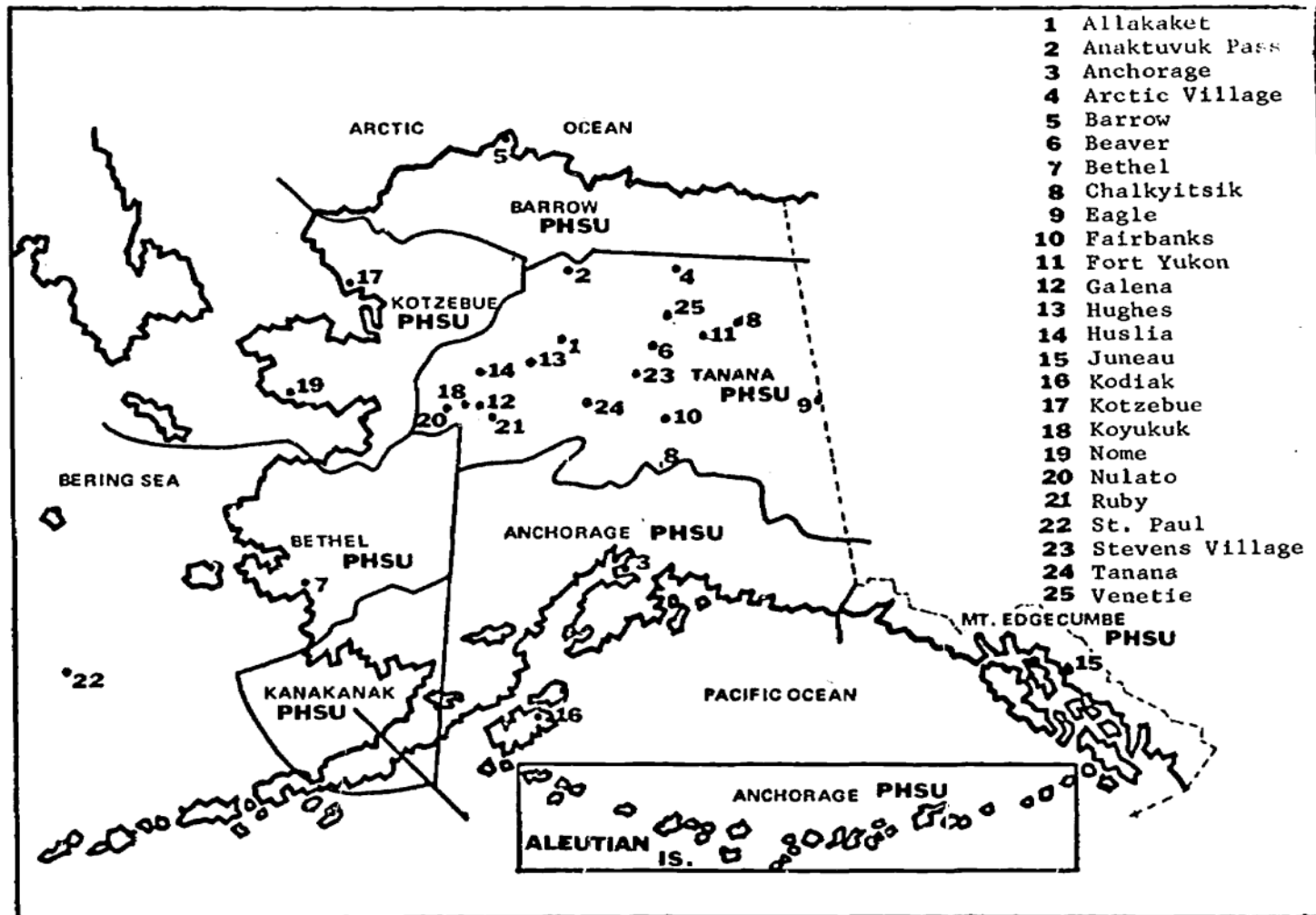
PHSU = Public Health Service Unit

Days of Communication for Village Clinics

	Before Satellite 1970-71	After Satellite 1971-72	After Satellite 1972-73
Satellite Villages	51.7 (14%)*	270.2 (74%)	310 (85.0%)
HF Radio Villages	44.0 (12%)	24.3 (7%)	N/A
* Of possible contact days			

Number of Episodes Treated with Doctor's Advice

	Before Satellite 1970-71	**After Satellite 1971-72**
Satellite Villages	47.1	184.6
HF Radio Villages	24.7	15.0

From "Bush Telegraph" to Broadband

- **Early days: communication by HF radio**
- **Since 1980s, all permanent communities of at least 25 people have telephone service**
- **>95% of households have telephones**
- **Broadband in Anchorage and large towns**
- **Rural/remote service typically 768 kbps**
- **Remote service by satellite:**
  - **Generally reliable, but latency, high cost**

Satellite Facilities

Alaska Fiber Optic System

**Community Access
in Rural Alaska:**
At the post office, at the store,
or under a tree…

Internet Access in Rural Alaska Schools

Village schools must offer K-12 if at least 10 students

Lack of specialized teachers

Use of Internet for homework, course content, online classes

Schools with E-rate as anchor tenants
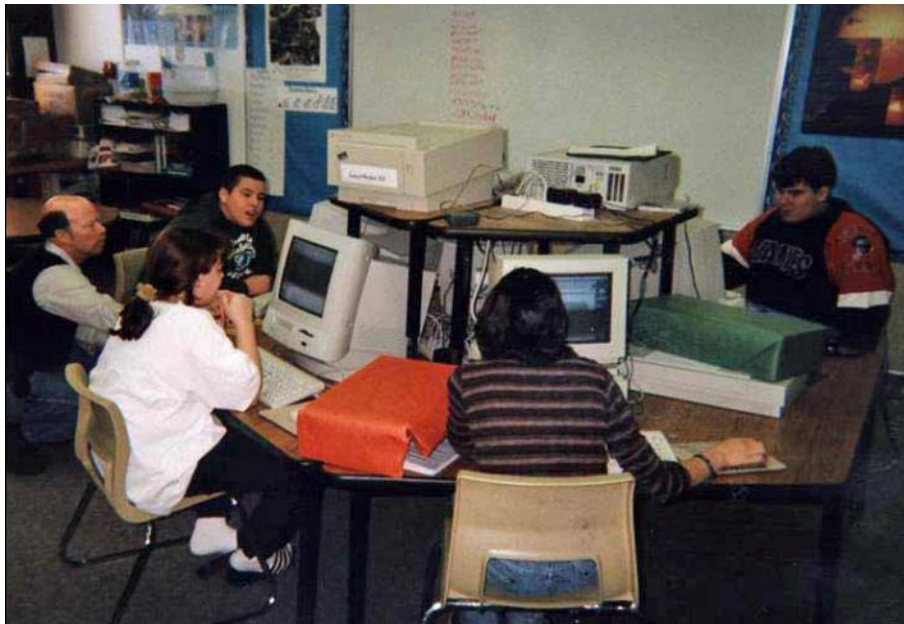
Telemedicine in Alaska Today:
The AFHCAN Network

AFHCAN Telehealth System:

253 sites; 70 member organizations

- **Village clinics: Native health aides**
- **Public Health clinics**
- **Regional hospitals**
- **Military installations, Coast Guard, Veterans Administration**

Covers more than 212,000 beneficiaries

- **About 40% of Alaska population**
- **Majority are in Alaska native villages**

- **Supported by USF Rural Health Care Program Alaska receives the largest amount of any State: $29m in 2009**

See www.afhcan.org

Design Evolution

- Base Cart include:
  - Metal Frame
  - Isolated Power System
  - CPU and LCD Touchscreen
  - Expansion Ports for USB, RS232, Video In/Out, External Display

- Currently Supported Peripherals include:
  - Video Otoscope
  - Digital Camera
  - Scanner
  - Video Conferencing
  - ECG
  - Spirometer
  - Tympanometer
  - Audiometer
  - Dental Camera
  - Vital Signs Monitor
  - Stethoscope

THE ALASKA NATIVE HEALTH CARE SYSTEM

Typical Referral Patterns

REFERRALS FROM:
- HOSPITALS
- MID HEALTH CENTERS
- PA/NP HEALTH CENTERS
- CHA CLINICS

THE ALASKA NATIVE HEALTH CARE SYSTEM

Location Names and Service Level

Nuiqsut to Barrow $390

Point Hope to Kotzebue $280

Savoonga to Nome $304

Chevak to Bethel $250

Old Harbor to Kodiak $156

● HOSPITALS
  MD HEALTH CENTERS
● PA/NP HEALTH CENTERS
●
♦ CHA CLINICS

Bold Face Names indicate that a higher level of Contract Health Care is available in that town.
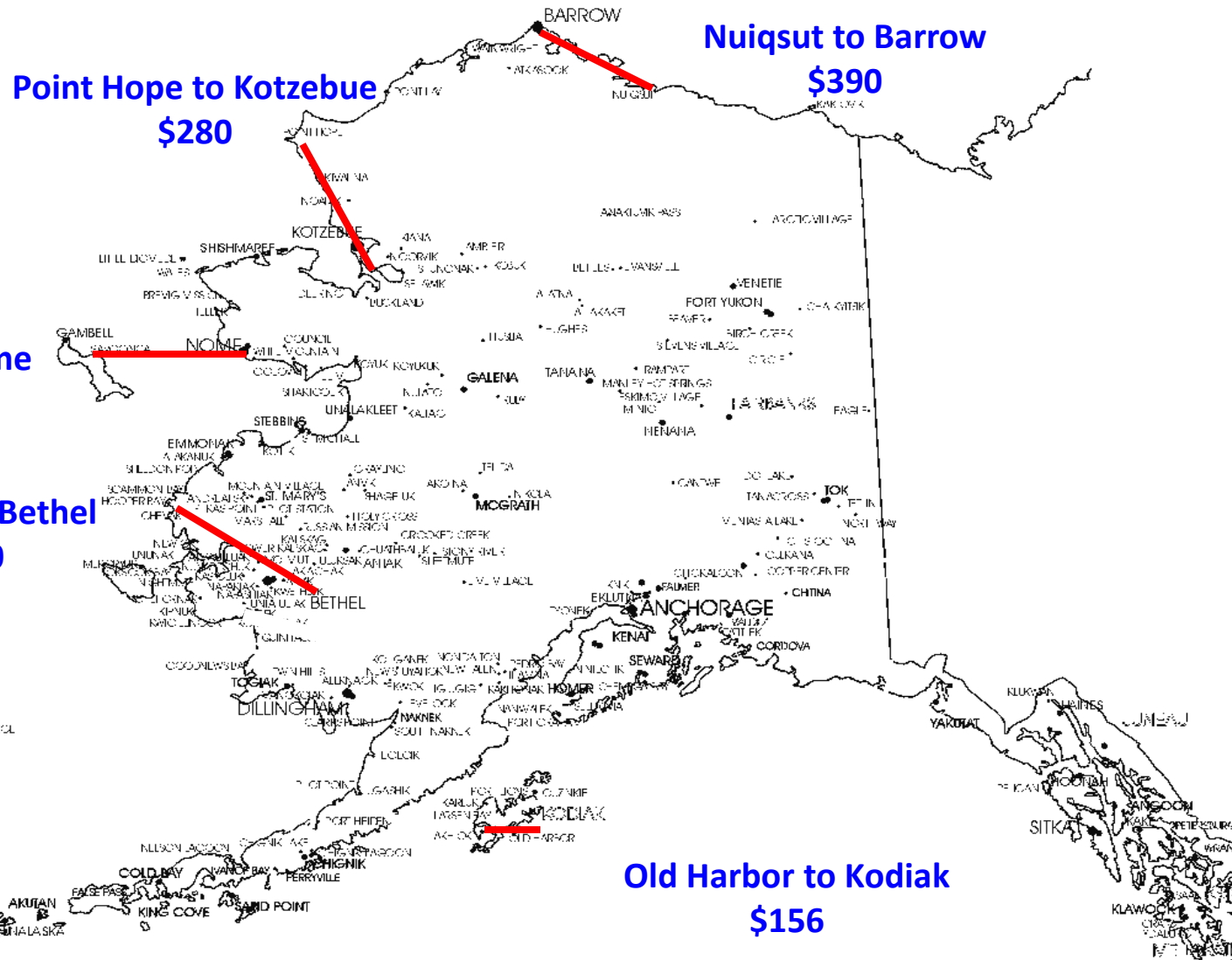
Kotzebue, Alaska:
Inupiat community on the Bering Sea...

- Has regional hospital
- Serves Inupiat villages in NW Alaska
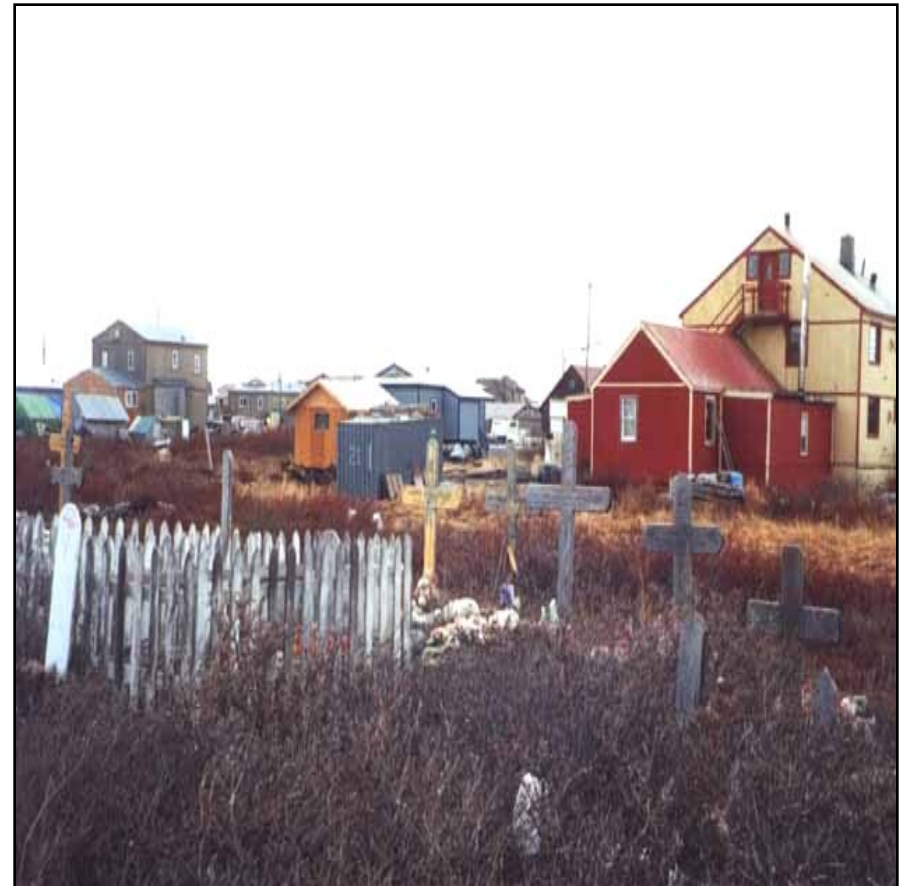
Telemedicine facilities for consultation between Alaskan regional hospital in Kotzebue and village clinics...
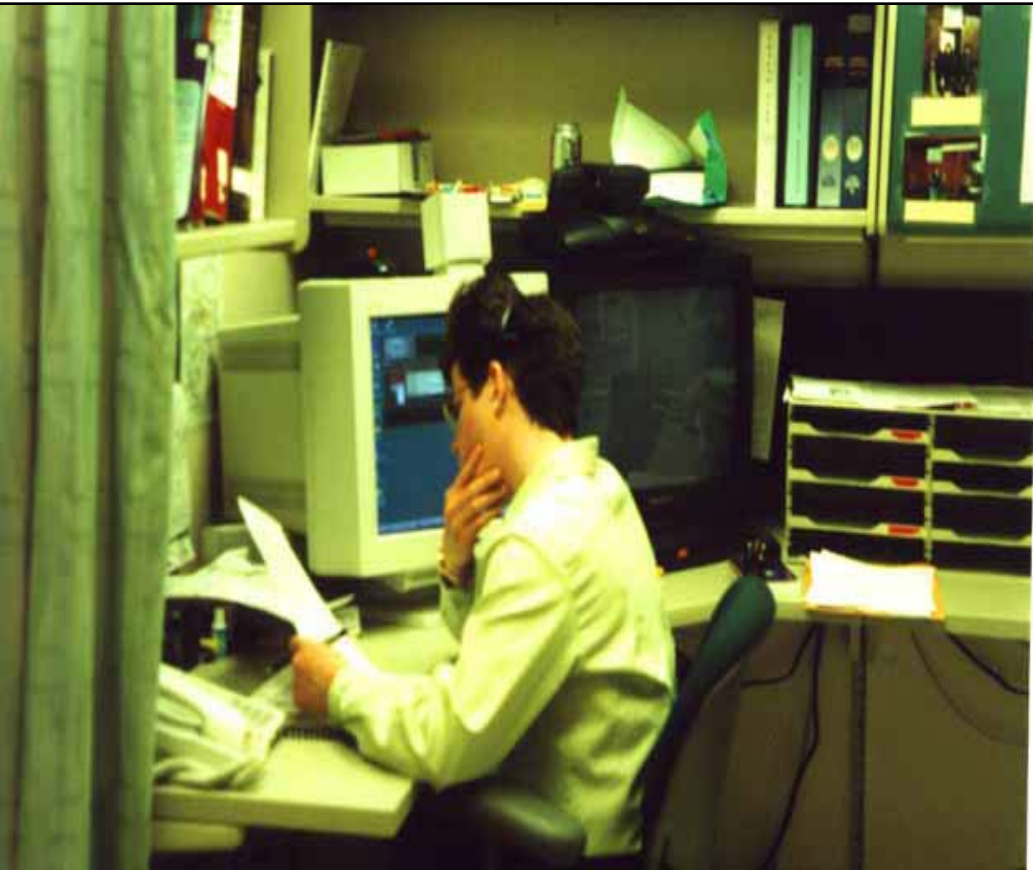
Telehealth: Emergency Delivery

- **A woman in Alaska's Northwest Arctic Borough goes into labor, hundreds of miles away from the nearest doctor**

- **Doctors 200 miles away, in the town of Kotzebue, guided the village's health practitioner through the delivery using live, two-way video and voice technologies**

- **Now more than half of doctors' contact with patients is through telemedicine and thousands of "tele-consultations" occur in the region each year**

Case originated...

Case received...Alaska Native Medical Center, Anchorage
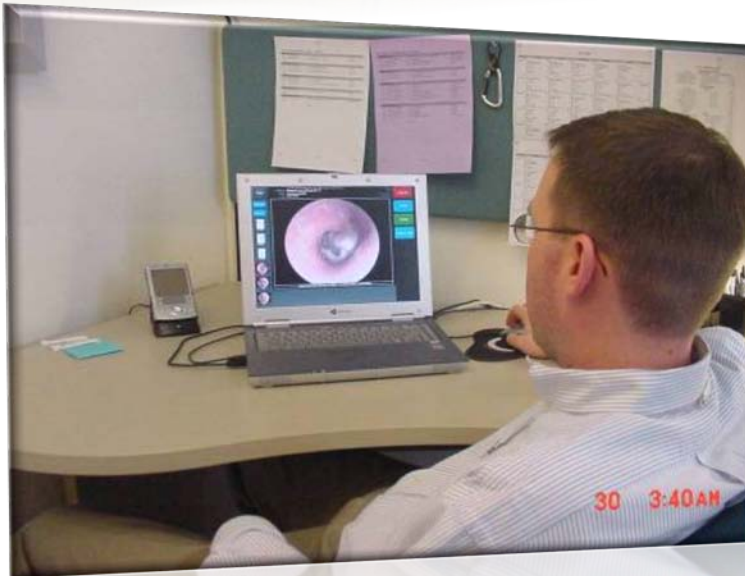
Telemedicine in Wales:
Inupiat Village on the Bering Sea

- **Closest mainland settlement to Siberia**
- **Part of Norton Sound Health District (Bering Straits Native Corporation)**
- **Regional Hospital in Nome**

Wales: Clinic and Telemedicine Facilities

Village Health Aides
using Telemedicine Facilities

What are your key organizational goals for telehealth applications?

GOALS FOR TELEMEDICINE
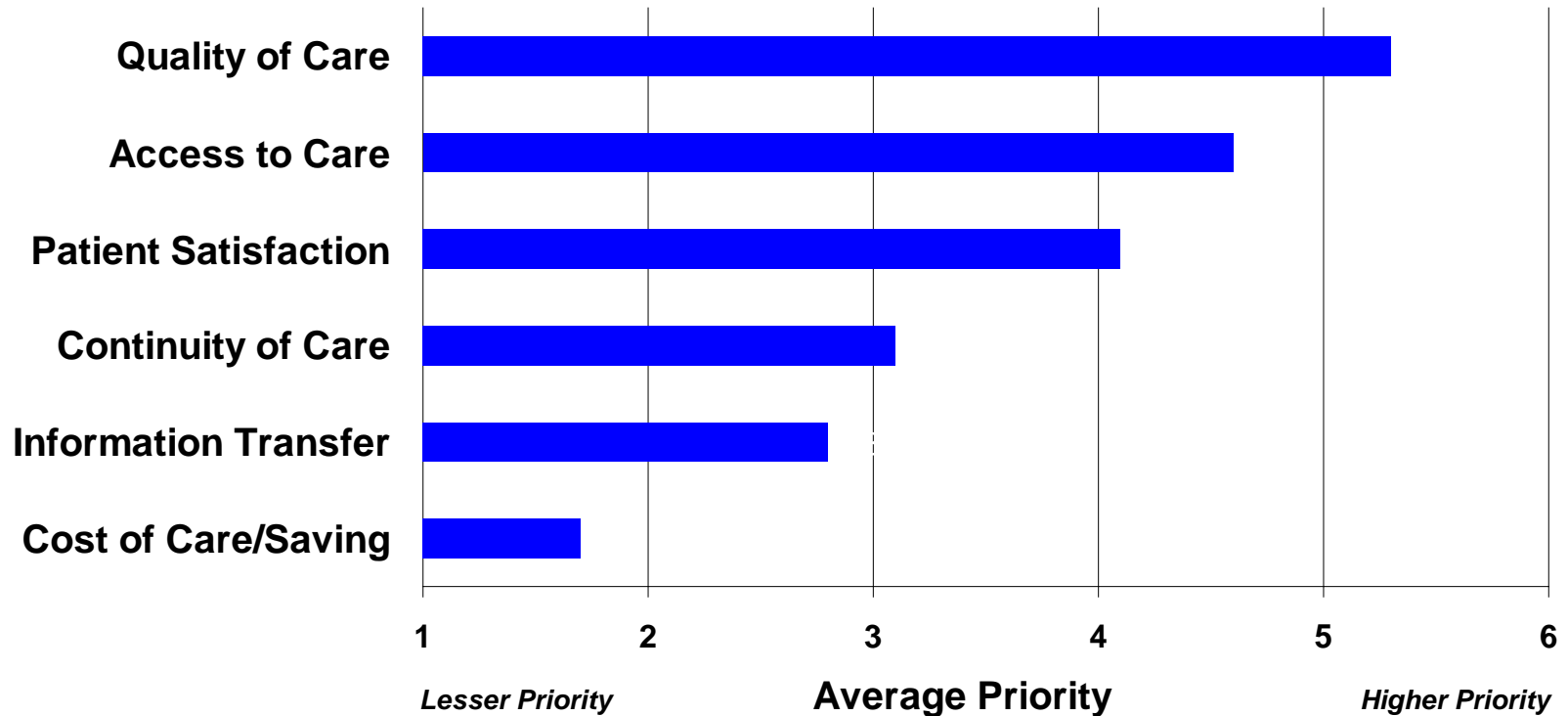
Store & Forward vs Real-Time Telehealth

Store & Forward

- Asynchronous Interaction
- Documents & Images
- Electronic Medical Records
- Patient Education

Remote consultation

Real-Time

- Face-to-Face Interaction
- Immediate Feedback

Clinical specialties for telemedicine

- Radiology
- Dermatology
- Pathology
- Oncology
- Ophthalmology
- Dental
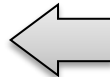
- Cardiology
- ENT
- GI
- Pulmonary
- Rheumatology
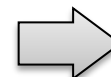
- Psychology/ Psychiatry
- Neurology
- Speech therapy
- Physical therapy

AFHCAN Telehealth

Cases Created per Year (by Role)
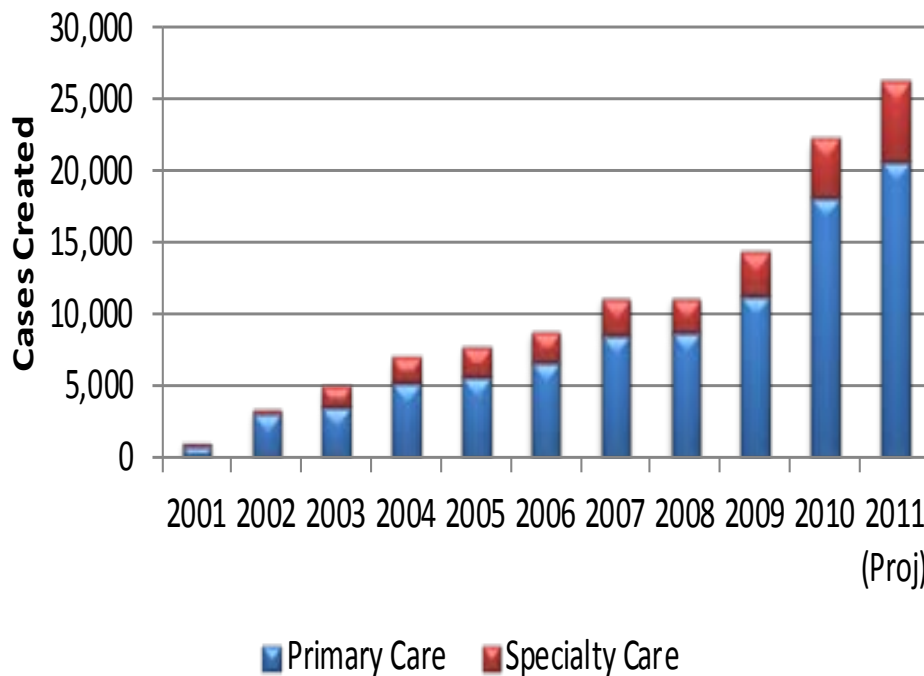
- **10 year Operational History**
  - **22,000 cases in 2010**

- **Whole Telehealth Solution**
  - **Design → Manufacturing → Deployment → Installation → Training → Support → Marketing**

**Data from AFHCAN,
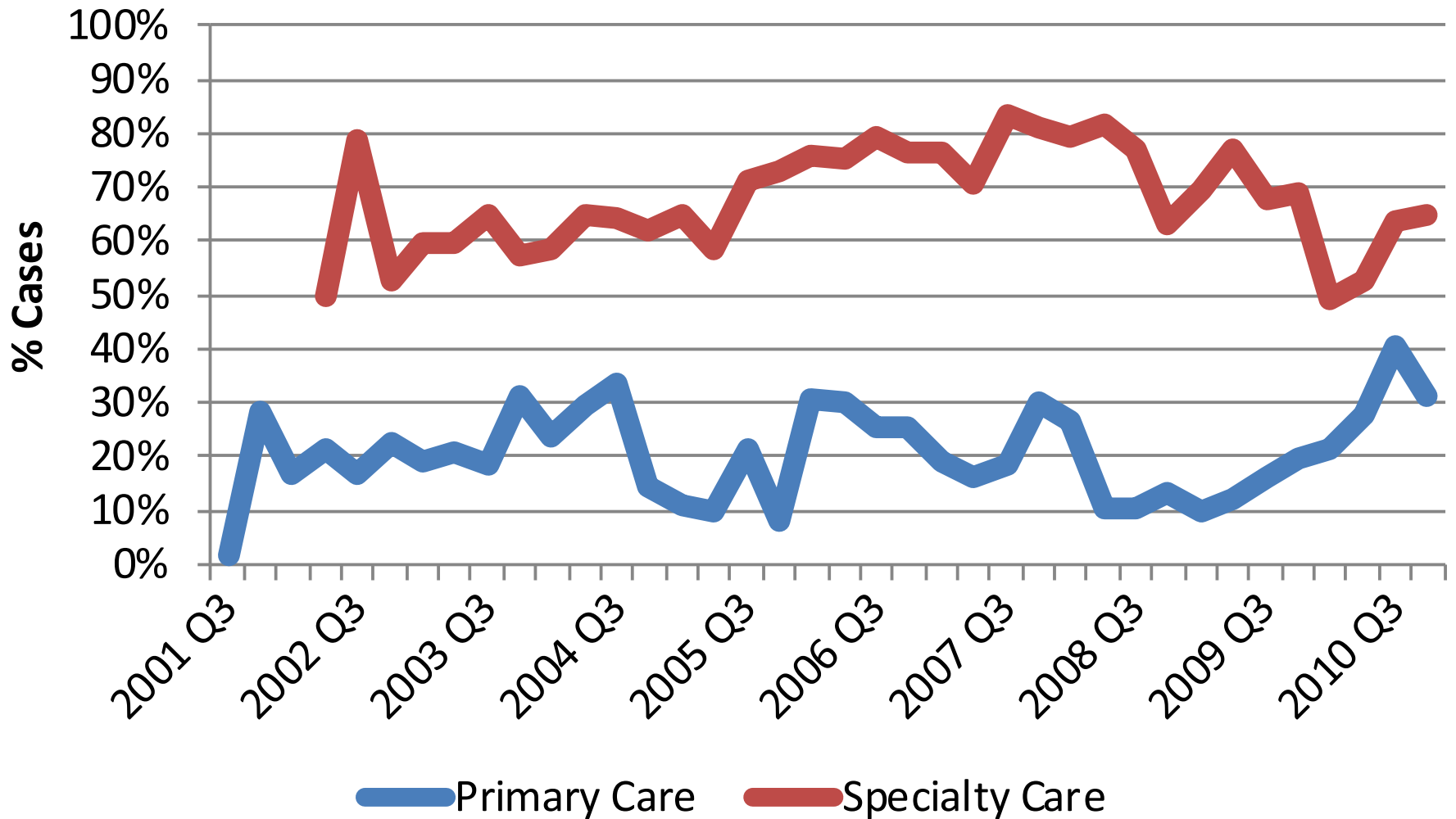Director Stewart Ferguson, Ph.D.**

Outcomes

Note1: 1,987 patients
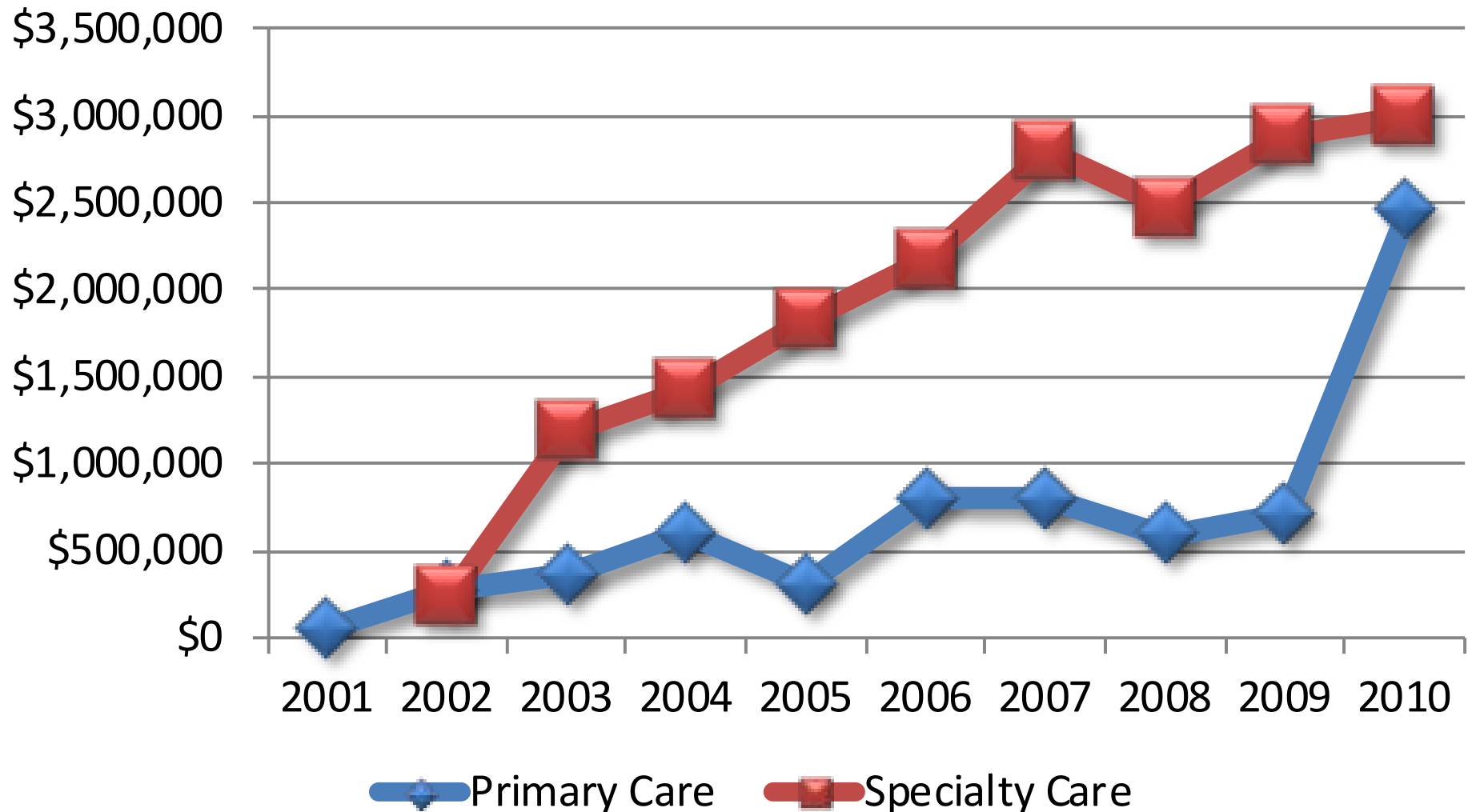Note2: Percentages may not add to 100% due to multiple outcomes per case.
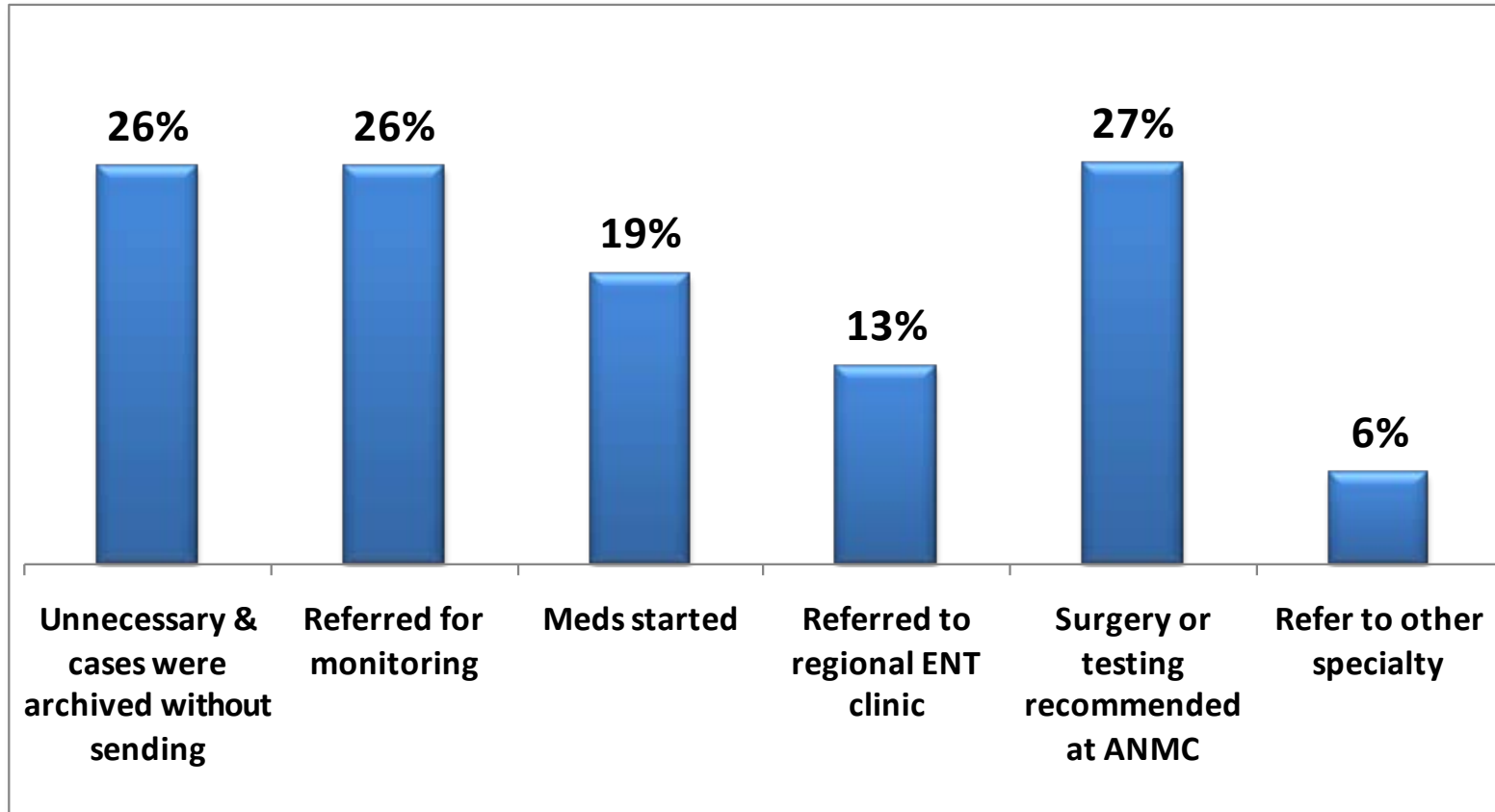
About 72% of the patients seen needed something done (meds, surgery, ongoing monitoring) and 26% needed to be screened out.

Travel PREVENTED (by Case Role)

Legend: Primary Care — Specialty Care

Annual Travel Savings (by Case Role)

Medicaid Study: 2003-2009
Decreased Travel = Cost Savings

	Quantity	Cost
Claims Paid by Medicaid	**4,482**	**($269,894)**
Telemedicine Prevented Travel	**3,662**	**$3,116,034**

Notes:
- **Travel is saved for 75% of all patients.**
- **Assume all patients under 18 need an escort**
- **Travel costs based on 1 week advance fares**

Net Savings Realized by Medicaid		**$2,846,140**

Note: For every $1 spent by Medicaid on reimbursement, $10.54 is saved on travel costs.

Telehealth Impact
on Extended Waiting Times (> 4 months)

Data courtesy of Phil Hofstetter
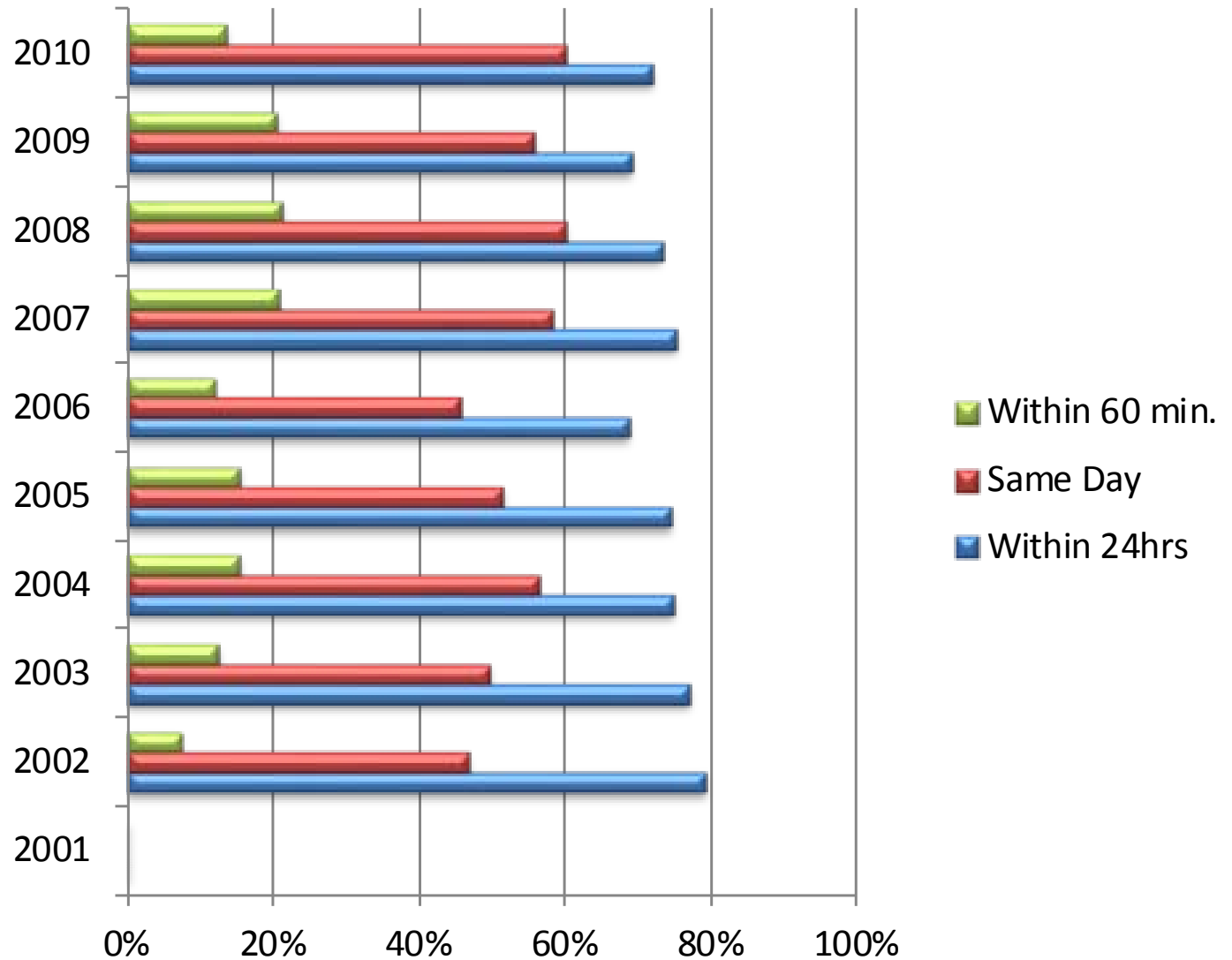
ANMC Turnaround Time
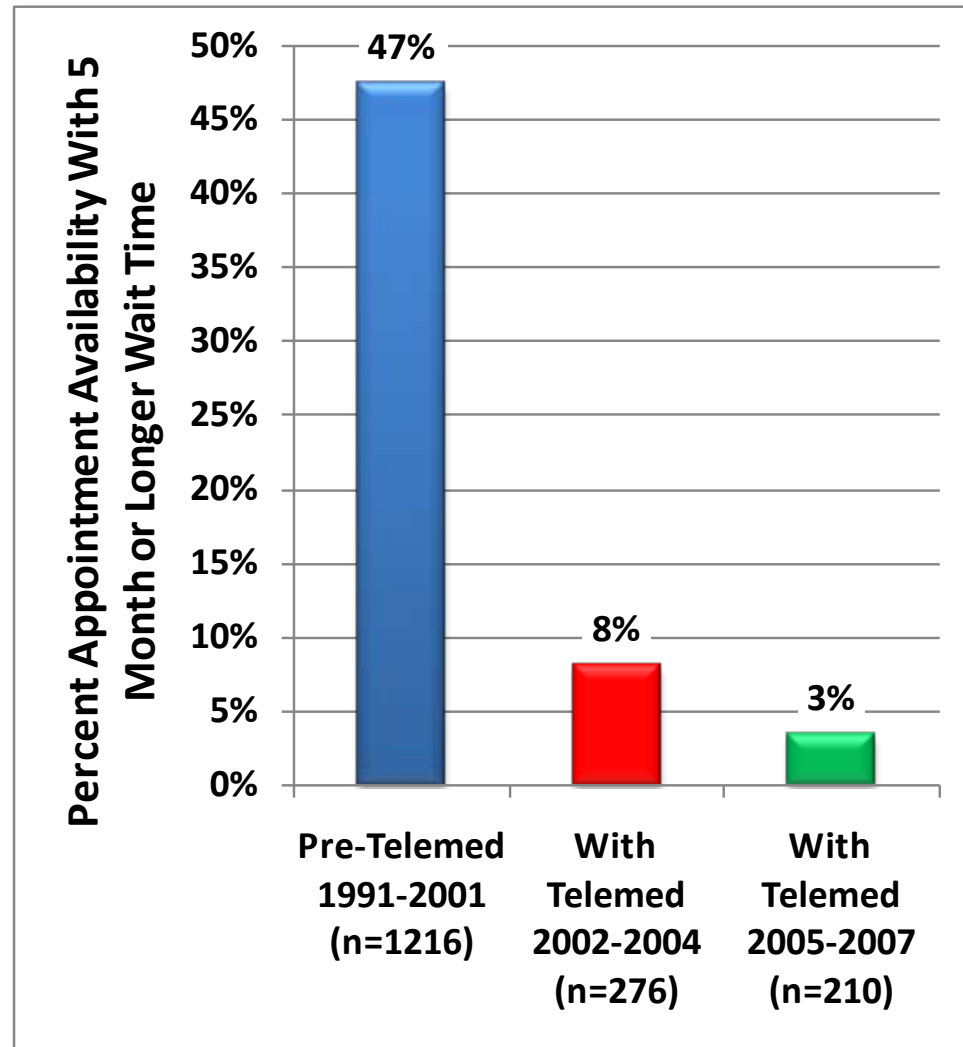
20% of all specialty consultations are turned around in 60 minutes.
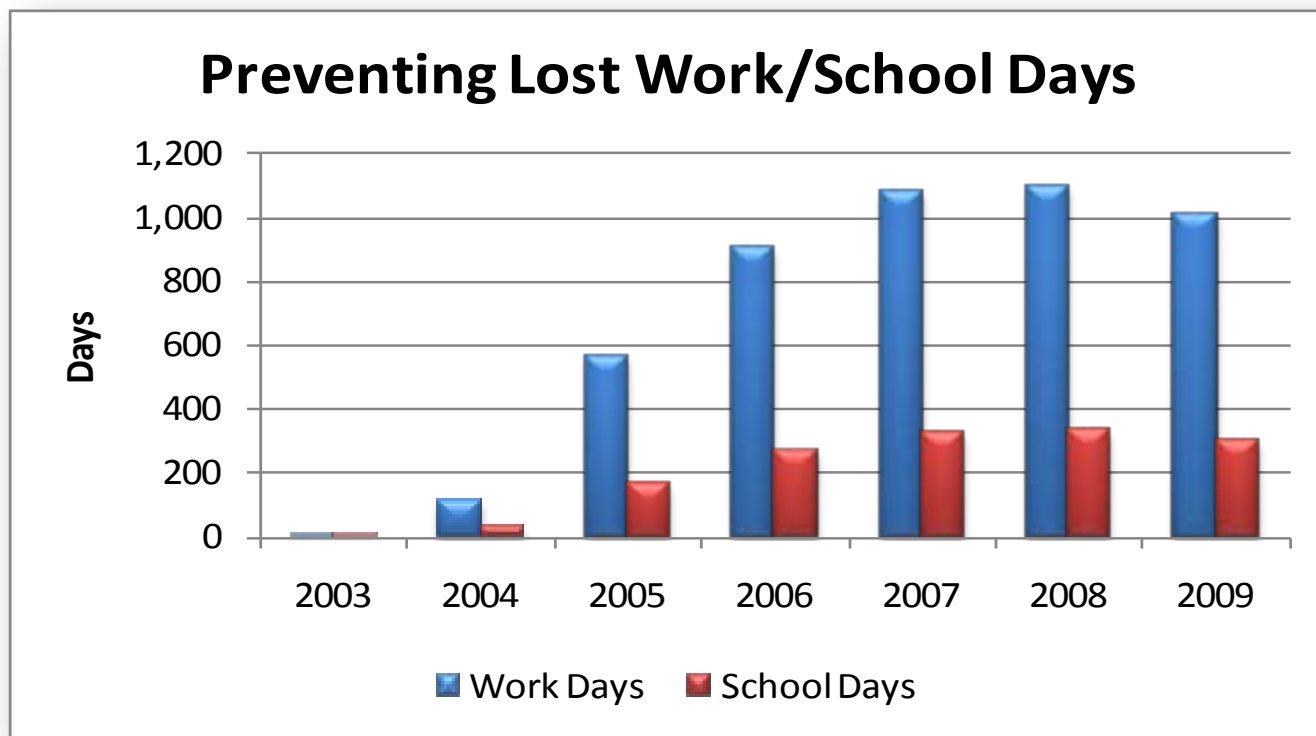
50%-60% are turned around in the same day.

70%-80% are turned around within 24 hours.

Lost Work Days and School Days

Preventing Lost Work/School Days

Since 2003, telehealth prevented an estimated 4,777 lost days at work, and a total of 1,444 lost days at school for the patients in this study.

Diabetic Retinopathy

- **Diabetic Retinopathy is the leading cause of new blindness among adults**

- **Blindness due to diabetes can be eliminated by timely diagnosis and treatment**

- **~ 4% of AI/AN's with DM need laser treatment to prevent vision loss**

Joslin Vision Network (JVN)
Portable JVN Pilot

Deployment of the IHS-JVN in Alaska using a portable platform reversed a seven year decline in exam rates
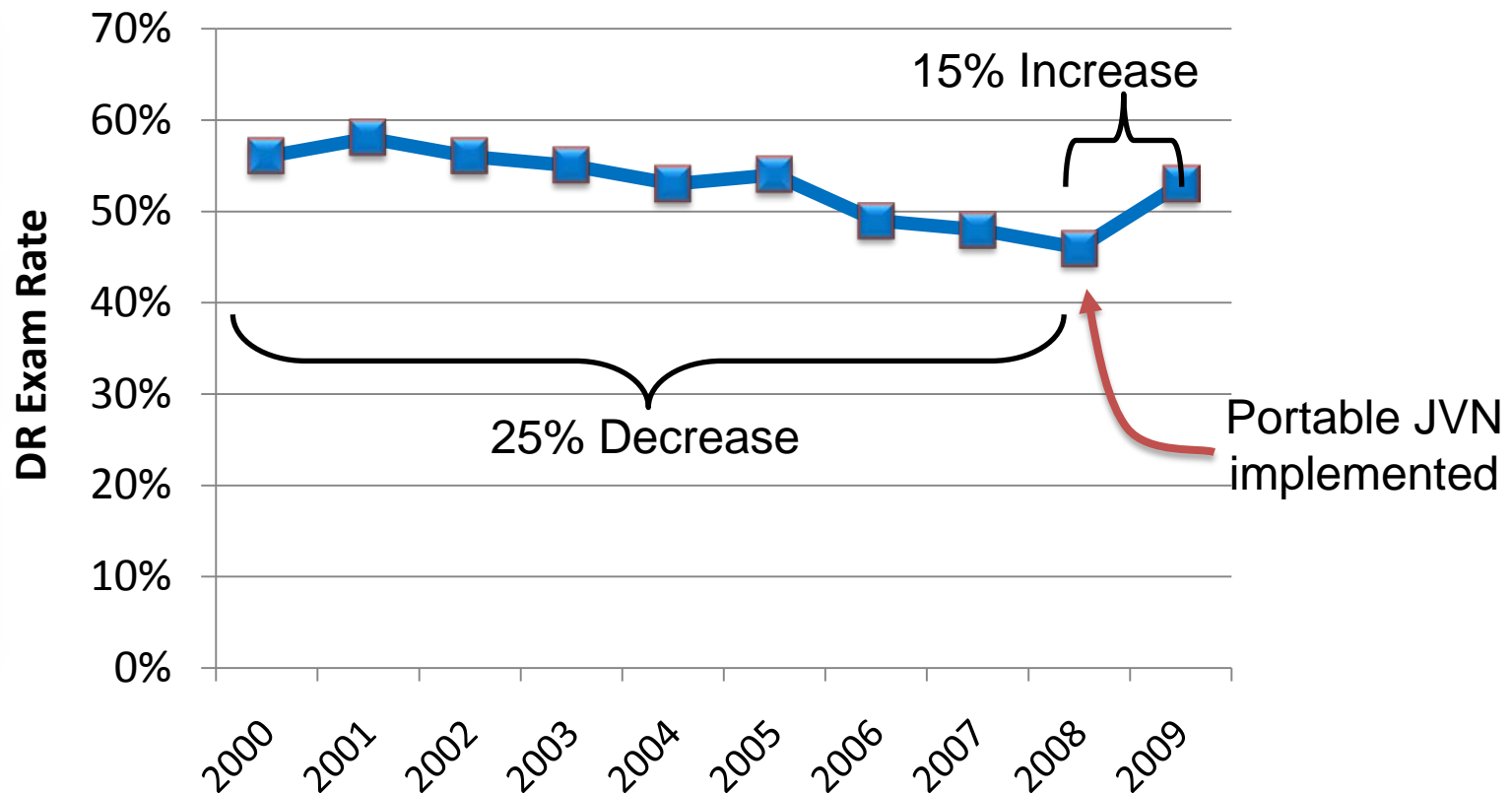
Cochlear Implants...

• Now implants can be done in Alaska with follow-up speech therapy using telehealth facilities in communities

• Previously, patient and family had to relocate to Seattle for a year for child to get necessary speech therapy
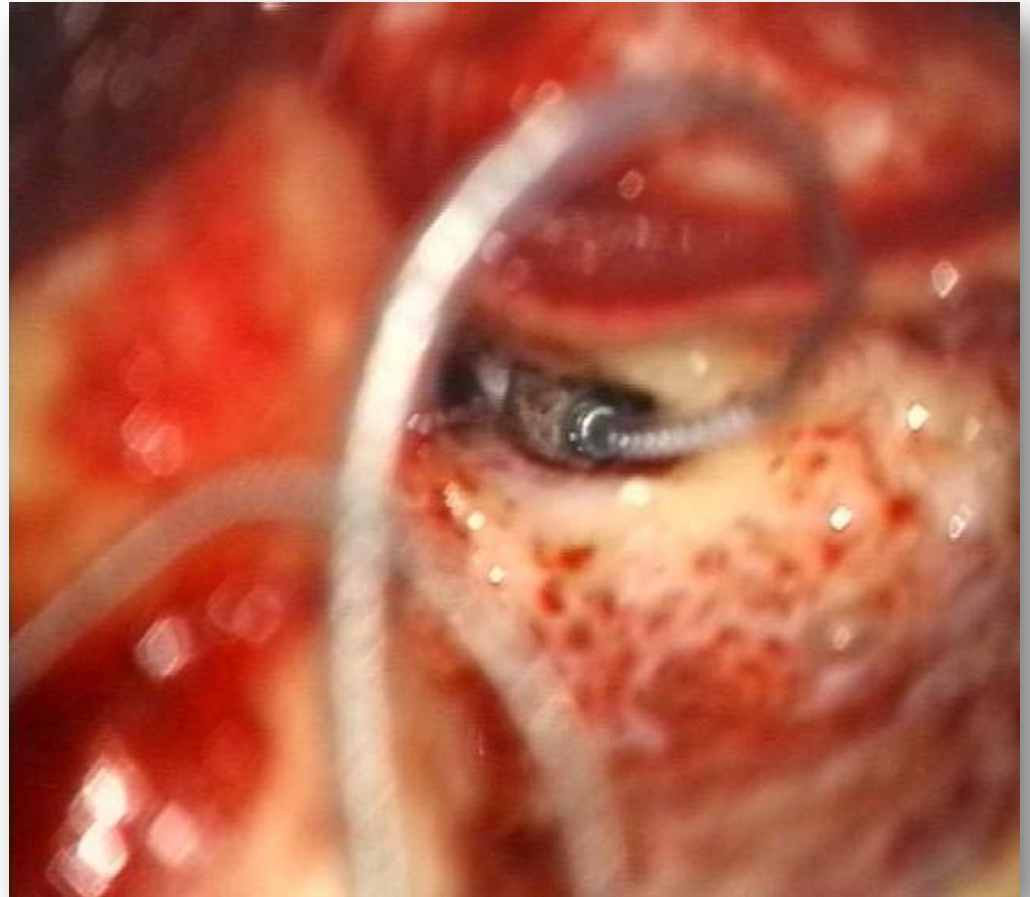
Lessons from AFHCAN

Design for Success:

- **KNOW THE NEEDS of your users (those who will use the system) and customers (those who will pay for the system).**

- **Plan for turnover → "Keep it Simple"**

- **Expect dynamic requirements → "Make it Scalable"**

-- Stewart Ferguson, Director, AFHCAN

Lessons from Alaska Telemedicine

- Reliable communication between health aides and physicians can improve timeliness and accuracy of patient diagnosis and treatment
- Telemedicine consults can reduce the need for transferring patients from their communities, although some serious conditions that might have been overlooked may require patient transfer
- Patients may be able to return to their communities sooner if they can be monitored by a health aide with consultation when required
- Telemedicine must address priority health problems to be cost/effective
- Communication with patients in hospital is important for family members in villages
- Administrative communication is also valuable for rural health care delivery

Lessons Learned…

- **Conference circuit (shared audio channel) is valuable for continuing education**
- **Structured continuing medical education and patient education require commitment of time, plus resources for organization and content**
- **Computerized patient records can improve efficiency and accuracy of patient-tracking, especially where patients appear at multiple locations**
- **Operational system planning needs to reflect user needs (e.g. on-demand access, shared audio channel, high reliability)**
- **Planning for sustainability post experimental phase is critical**
- **Health care system can be "anchor tenant" for village communications**
- **Creative approaches to network design, operations, and maintenance can significantly reduce costs of rural communications for telemedicine and other services**

THANK YOU
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