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A Prospective Evaluation of ENT Telemedicine in Remote Military Populations Seeking Specialty Care

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ABSTRACT

This study evaluated telemedicine use in remote military treatment facilities (MTFs) ashore over a 4-month period to help guide telemedicine applications for shipboard medical departments. A prospective study design was used to evaluate specialty care provided by an ear/nose/throat (ENT) physician via videoconferencing (VC) for patients at remote MTFs in TRICARE Region 9. The study provided a complete and continuous sample of ENT consultations during a planned 4-month period. Data sources included a telemedicine database and telephone interviews to assess attitudes of physician and nonphysician medical personnel. A total of 193 VC consultations (hereafter referred to as teleconsultations) were conducted following referrals from primary providers. Patients were mostly young, male, active-duty personnel. Forty-five percent of the 193 teleconsultations resulted in changed diagnosis by the ENT specialist relative to initial diagnosis by the referring provider. This rate of clinical impact was substantial, and it generalized across various ENT conditions, demographics, and MTFs. Medical personnel reported generally positive attitudes about telemedicine technologies and the telemedicine process in TRICARE Region 9. Nonphysician providers reported slightly more favorable attitudes compared to physicians. These results suggest that ENT telemedicine has substantial clinical impact in the military populations treated at MTFs. A high rate of changed diagnoses (45%) was observed across age, gender, military status, ENT conditions, and treatment facilities. Medical personnel reported positive attitudes about using the telemedicine system. These results support the use of telemedicine in shipboard medical departments.

INTRODUCTION

IT HAS BECOME INCREASINGLY CLEAR that effective application of telemedicine technologies such as email, the Internet, and live videoconferencing (VC) is essential for the U.S. armed forces to optimize their health care mission.¹⁻⁴ This is especially true for personnel deployed or stationed in remote environments.^{5,6} Tele-

medicine can provide timely access to specialized care for patients and medical personnel on ships at sea with limited medical resources.⁶ Telemedicine provides many benefits,⁷⁻⁹ which extend to personnel and their dependents treated at Military Treatment Facilities (MTFs) in medically underserved regions ashore.^{10,11}

This study evolved from a naval research directive to determine how telemedicine could

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support shipboard medical departments.¹ Larger ships, such as carriers and amphibious ships, have extensive medical departments, including physician and nonphysician personnel, to perform the functions of a small hospital (e.g., surgery). Some ships have telemedicine technologies such as the Internet, VC, and computed radiology installed.¹² Unfortunately, the few evaluation studies of shipboard telemedicine processes that exist are limited to these large ships.¹³ No organized telemedicine capabilities currently exist on small ships, such as cruisers and destroyers, to assist medical departments headed by nonphysicians, such as independent duty corpsmen (IDCs).⁶ Evaluating telemedicine networks currently used at MTFs ashore provides an opportunity to study telemedicine use by military medical personnel and patient populations; results may generalize to help guide applications for shipboard medical departments. Some have pointed out that the field of telemedicine in general needs more systematic evaluation studies.^{14,15}

This study followed up on a retrospective evaluation of the first 2.5 years of telemedicine network operation in TRICARE Region 9.¹¹ In Region 9, remote MTFs, such as Fort Irwin and Port Hueneme, access specialty care by physicians at Naval Medical Center, San Diego via live VC. The retrospective study showed that telemedicine use increased with time (since operational) at various MTFs and the duration of operation of individual telemedicine specialties, e.g., ear/nose/throat (ENT). In addition, the retrospective data suggested that approximately half of ENT consultations had a clinical impact, measured by change in diagnosis.

The present study extended the retrospective study of Region 9 telemedicine in two ways: (1) Analysis focused on determining a reliable rate of clinical impact, namely whether diagnosis changed, for ENT telemedicine over a planned 4-month study period. ENT conditions can pose a concern for shipboard medical departments,¹⁶⁻¹⁸ and little evaluation exists of ENT teleconsultations in MTFs.^{19,20} The generality of these procedures for different ENT conditions and patient populations is unclear. (2) Interviews with military medical personnel, e.g., general medical officers (GMOs), IDCs, and

medical technicians, were conducted to assess their attitudes and experiences with Region 9 telemedicine. Some evidence indicates that telemedicine attitudes (e.g., satisfaction) and experience are positively correlated with telemedicine use.²¹ Thus, satisfaction with telemedicine and experiences with telemedicine and related technologies were measured among physician and nonphysician medical personnel.

METHODS

This was a prospective evaluation of telemedicine teleconsultations that were conducted by an ENT specialty physician. The data were extracted from a telemedicine database called the referral management system (RMS) and from structured interviews with physician and nonphysician medical personnel. The study was conducted over a planned 4-month period and included patient consultations and medical personnel at remote MTFs in TRICARE Region 9 and Lemoore Naval Air Station.

Data sources and subjects

Observations came from two sources: (1) A database of telemedicine consultations and (2) structured interviews with medical personnel.

Referral management system database

The telemedicine consultations ($n = 193$) occurred between November 1, 2000, and March 1, 2001, and were extracted from the database. These were all sessions in which primary providers referred patients for consultations with an ENT specialist for initial evaluation. These consultations were provided for patients treated at treatment facilities in TRICARE Region 9 and at Lemoore Naval Air Station. These facilities comprise the functional telemedicine network centered at NMCSO.¹¹ Individual patients contributed one or more observations for one or more medical conditions.

Medical personnel

Medical personnel from the Region 9 telemedicine network completed telephone in-

interviews. These were physicians ($n = 8$) and nonphysicians ($n = 7$), 11 males and 4 females. The physicians consisted of 2 GMOs, 3 primary care physicians, and 3 specialty physicians (child psychiatry, ENT and neurology). The nonphysicians consisted of 1 IDC, 4 medical technicians, 1 nurse, and 1 physician's assistant. Of the 15, 12 were on active duty and 3 were civilians. This was a targeted sample based on advice of the telemedicine coordinator in TRICARE Region 9, who identified those who worked on these telemedicine consultations. Over 90% of those targeted were contacted and completed the interview. A few military personnel had transferred to another assignment and were unavailable. There were no more than a few telemedicine personnel at each clinic and at least 1 and as many as 4 medical personnel surveyed worked in each of 8 MTFs. There were approximately 25 telemedicine personnel working in Region 9 telemedicine during the study period. An exact number is difficult to determine due to turnover and part time assignments.

TRICARE region 9 telemedicine network

TRICARE provides healthcare for active-duty personnel, their qualified family members, Civilian Health and Medical Program of the Uniformed Services-eligible retirees, and the families and survivors of all uniformed services.

The telemedicine network in southern California includes 8 MTFs [Naval Medical Center, San Diego, Port Hueneme, Fort Irwin, Edwards Air Force Base (AFB), Vandenberg AFB, Twentynine Palms, Los Angeles AFB, Lemoore NAS], most with limitations on medical specialization. NMCSO functions as the "hub" of the telemedicine network. The remote MTFs are the "spokes" at various distances from NMCSO (121–320 miles). Although the Lemoore facility is not part of Region 9, it was included because it is part of the functional telemedicine network centered at NMCSO. The spoke facilities received telemedicine consultations from the ENT specialist at the hub in San Diego. Such a "hub-and-spoke" telemedicine network model has been applied frequently in recent years in many settings.^{8,22}

Referral management system

Telemedicine consultations were managed and recorded via a secure Web-based application installed for Region 9. When a primary provider at a remote facility determined that a patient required specialty consultation, the patient was referred to a telemedicine coordinator. If the specialty care was not available at the patient's site, the telemedicine coordinator (e.g., medical technician) scheduled a teleconsultation with the ENT physician. The patient at the remote site then was registered in the system along with information about background, symptoms, and primary provider diagnosis. The ENT specialist at San Diego then accessed the referral management system for scheduled consultations and patient case information.

During the consultation itself, the telemedicine coordinator presented the patient to the consultant via VC and executed relevant ENT examination procedures. Following the telemedicine appointment, the consultant entered comments on diagnosis and treatment in the patient's record.

The choice of ENT specialty for this study was based on the fact that such consultations were the most common in TRICARE Region 9.¹¹ Initial evaluations were chosen because these are the sessions where the primary provider and specialist determine diagnosis. In this study, store-and-forward, preoperative or postoperative, or follow-up sessions were excluded because these sessions usually did not function to determine diagnoses. The ENT telemedicine examinations depended on real-time videoconferencing, unlike other specialties. For instance, dermatology makes extensive use of the store-and-forward process such as emailing of digital pictures to determine diagnosis.³

The following variables were extracted from the database:

- Patient demographics (age, gender, and military status)
- Reason for consultation (initial, preoperative, postoperative follow-up, other)
- Patient and primary provider site
- Consultant medical specialization (ENT, neurology, psychiatry, rheumatology)

- Primary provider and consultant diagnosis (provider and consultant comments were coded into ICD-9 categories)
- Telemedicine modality (VC or store-and-forward)
- Usefulness of technologies
- Perception of telemedicine (e.g., "Telemedicine allows me to give better health care to my patients").

The ENT consultations included a diversity of problems. All cases were assigned to one of the following five categories: hearing (e.g., tinnitus), sleep-related (e.g., sleep apnea), tonsil-related, upper respiratory (e.g., sinusitis), and integumentary (e.g., skin cyst). These categories were chosen in consultation with the lead ENT specialist. Thus, it was possible to see the relative frequency of major ENT conditions in this population, and to determine variation in clinical impact of teleconsultations among these types of cases.

Interviews with medical personnel

The medical personnel completed brief telephone interviews, approximately 10 minutes in length, to determine their medical backgrounds and experience with technology, and to assess their attitudes toward telemedicine. These interviews were conducted at the end of the study period according to a structured questionnaire format. The questions and interview forms were based on those used in previous work at Naval Health Research Center.¹³ The format was influenced by Dillman's²³ methodology for mail questionnaires.

The following variables were recorded from the interview forms:

- Medical positions (e.g., IDC, nurse, physician) and specialization (e.g., dermatology, psychiatry)
- Years experience with telecommunications technologies (e.g., VC, Internet, e-mail)
- Medical purpose for telemedicine use (e.g., confirm diagnosis, patient education)
- Attitudes were assessed using a 5-point Likert rating scale (e.g., 1 = very satisfied, 2 = somewhat satisfied, 3 = undecided, 4 = somewhat dissatisfied, 5 = very dissatisfied). Five to 7 questions were used to assess each of four different attitudinal variables:
- Satisfaction with technologies
- Satisfaction with modalities (e.g., sound, images)

Data analysis

The data analysis addressed the following questions:

- What percentage of teleconsultations had clinical significance, namely a difference in diagnosis between the primary provider and the ENT specialist?
- Which, if any, demographic or patient conditions were associated with changed diagnoses?
- What were attitudes and experiences of medical personnel regarding telemedicine? Were these attitudes and experiences related to telemedicine use? Did attitudes vary by level of medical training (i.e., physician or nonphysician)?

Chi-square tests ($p < 0.05$) were conducted to test for the significance of associations between change in diagnosis and ENT condition, gender, and military status. The sample sizes for other variables were too small to permit this test.

Descriptive statistics are presented for the interview data. Preliminary trends are described for the interview data because of the small samples of 8 physicians and 7 nonphysician medical personnel. Thus, the comparisons between physicians and nonphysicians should be interpreted with caution.

RESULTS

A total of 193 ENT teleconsultations were conducted following referrals from primary providers. Forty-five percent of these consultations led to a change in diagnosis by an ENT specialty physician relative to the initial diagnosis by the referring provider. This rate of change generalized across different ENT problems, age, gender, military status, and facility site.

Medical personnel reported generally positive attitudes toward telemedicine technologies

and the telemedicine process in TRICARE Region 9. Compared with physicians, nonphysicians reported slightly more favorable attitudes and used telemedicine more often and in more ways.

Demographics

The sample consisted of approximately 70% active-duty adult males between 18 and 44 years old (Table 1) and 30% females and military dependents. Over 75% of the consultations came from the Lemoore or Port Hueneme facilities. An interruption in certification of the ENT specialist by Fort Irwin and Edwards AFB limited ENT telemedicine at these sites. The demographic variables will be considered for possible associations with rate of diagnosis change.

Clinical impact

Almost half (45%) of the consultations produced a change in patient diagnosis by the ENT specialist relative to the initial diagnosis of the primary provider (Fig. 1).

Because the ENT cases included diverse medical problems (e.g., hearing- and sleep-re-

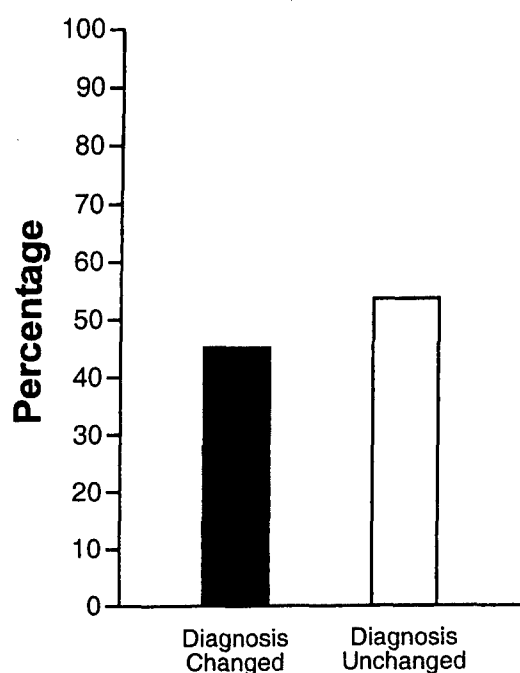


FIG. 1. Clinical impact of VC consultations.

TABLE 1. DEMOGRAPHICS FOR PATIENTS REFERRED FOR ENT CONSULTATIONS VIA VC

Total consults	n = 193	% = 100
Gender		
Male	133	68.9
Female	58	30.1
Unknown	2	1.0
Age, years		
1-10	19	9.8
11-17	5	2.6
18-24	50	25.9
25-44	92	47.7
45-65	19	9.8
65+	7	3.6
Unknown	1	.5
Military status		
Active duty	132	68.4
Dependent	59	30.6
Unknown	2	1.0
MTF		
Lemoore NAS	110	57.0
Port Hueneme	48	24.9
Twentynine Palms	17	8.8
Fort Irwin	15	7.8
Edwards AFB	3	1.6

ENT, ear/nose/throat; MTF, military treatment facility; VC, video teleconferencing.

lated), this study explored whether the overall rate of clinical impact (Fig. 1) was general or limited to certain types of ENT problems, demographic (e.g., age and gender), or institutional variables (e.g., military or dependent status). Table 2 shows rates of diagnosis change as a function of these variables.

Table 2 shows that the rate of diagnosis change for the ENT consultations did not vary by ENT problem, gender, age, military status, and or facility site. No significant deviations occurred among the major ENT categories (i.e., hearing, sleep, tonsil, upper respiratory [$\chi^2(3) = 1.43, p > 0.05$]). However, none of the 5 integumentary cases led to a changed diagnosis; larger samples would be needed to determine the reliability of this latter trend. Similarly, no significant differences were seen within gender [$\chi^2(1) = 0.97, p > 0.05$] or military status [$\chi^2(1) = 1.05, p > 0.05$].

It may be noted that active-duty cases and those 18-64 years old showed rates of diagnosis change similar to those found in the overall sample. The various facility sites also appeared to have similar rates of diagnosis change, but compliance problems and small samples sizes from some facilities did not allow significance tests. The lack of substantial variation by these

TABLE 2. CLINICAL IMPACT OF VC CONSULTATIONS
BY SECONDARY VARIABLES

Overall summary	Diagnosis changed		No change	
	n = 87	% = 45	n = 106	% = 55
Type of ENT problem				
Hearing/vertigo	23	46	27	54
Sleep	12	38	20	62
Tonsil	13	46	15	54
Upper respiratory	39	50	39	50
Integumentary	0	0	5	100
Gender				
Male	63	47	70	53
Female	23	40	35	60
Age, years				
1-10	6	32	13	68
11-17	2	40	3	60
18-24	22	44	28	56
25-44	43	47	49	53
45-64	9	47	10	53
65+	5	71	2	29
Military status				
Active duty	62	47	70	53
Dependent	23	39	36	61
MTF				
Lemoore NAS	48	44	62	56
Port Hueneme	26	54	22	46
Twentynine Palms	5	29	12	71
Fort Irwin	6	40	9	60
Edwards AFB	2	67	1	33

Totals less than 193 cases reflect 1 or 2 missing cases for certain variables (e.g. 192 for age and gender, 191 for military status). VC, Video teleconferencing.

variables supports the generality of the overall rate of diagnosis change.

Interviews with medical personnel

Structured interviews of 8 physicians and 7 nonphysician medical personnel from the TRICARE Region 9 telemedicine network supplemented the data on patient outcomes.

Past telemedicine use

Table 3 shows the medical reasons for which the physician and nonphysician medical personnel said they had ever used telemedicine. The primary reason given for past telemedicine use was to confirm diagnosis. All but 1 of the 15 medical personnel had at some point used each of the telemedicine technologies to confirm diagnosis.

TABLE 3. PAST USE OF TELEMEDICINE TECHNOLOGIES BY MEDICAL PERSONNEL

Telemedicine technology	Physicians (n = 8)		Nonphysicians (n = 7)	
	Diagnosis confirmation (%)	Education (%)	Diagnosis confirmation (%)	Education (%)
Telephone	100	38	100	76
Fax	86	13	100	40
Email	93	38	100	81
Internet	100	75	100	85
VC	100	75	100	62
Overall average	95	48	100	69

VC, video teleconferencing.

TABLE 4. CURRENT ACCESS TO TELEMEDICINE TECHNOLOGIES BY MEDICAL PERSONNEL

Technology	Physicians (n = 8)		Nonphysicians (n = 7)	
	Current access (%)	Years used (M)	Current access (%)	Years used (M)
E-mail	75	6.3	100	3.0
RMS	75	1.5	100	1.7
Internet	75	3.6	100	3.6
VC	75	2	100	1.7

RMS, Referral Management System; VC, video conferencing.

The physicians and nonphysicians differed somewhat in past use of telemedicine for educational purposes (patient or provider). The nonphysicians were consistently more likely than physicians to use telemedicine for educational reasons. At least 70% of both groups had used the Internet to obtain medical information.

Current access to telemedicine technologies

Table 4 shows that all nonphysicians and most physicians in the study had current access to various telemedicine technologies. All participants reported well over 1 year of experience with each technology. Physicians and nonphysicians reported similar experience with technology.

Purposes of telemedicine use

Table 5 shows the reasons physicians and nonphysicians used telemedicine during the study period (last 4 months). One of the physicians was excluded from this analysis for lack of involvement with telemedicine (last 4 months).

More than three-fourths of all telemedicine activity was initiated to confirm diagnosis. This was true for both groups. However, differences between physicians and nonphysicians were observed. Physicians were more likely than nonphysicians to use telemedicine for patient education. In contrast, the nonphysicians were

more likely to use telemedicine for their own education and for technical support.

Telemedicine activity and satisfaction

Table 6 summarizes medical personnel reports of overall patient load and telemedicine activity during the study period (last 4 months). Table 7 shows scores for satisfaction, usefulness, and overall perception of telemedicine technologies (e.g., e-mail, VC) and satisfaction with different modalities (images, sound, written text).

Level of telemedicine activity

Nonphysicians reported more telemedicine activity than physicians, as shown in Table 6. This is seen both in the number of telemedicine cases and in the ratio of telemedicine cases to all patient care (telemedicine cases/telemedicine plus non-telemedicine cases). This was primarily because a nonphysician at each clinic was tasked to run all telemedicine sessions including ENT, neurology, and psychiatry. In contrast, physicians other than the ENT specialist used telemedicine infrequently in Region 9.¹¹ Substantial variability occurred among both physicians and nonphysicians on these measures, but the sample sizes were quite small ($n = 7$, $n = 7$). To reduce the effect of extreme fluctuations, median scores are presented here.

TABLE 5. RECENT TELEMEDICINE USAGE BY MEDICAL PURPOSE

	Confirm diagnosis (%)	Patient education (%)	Provider education (%)	Technical support (%)	Unknown (%)
Physician (n = 7)	79	19	1	1	0
Nonphysician (n = 7)	77	4	9	9	1

TABLE 6. TELEMEDICINE ACTIVITY REPORTED BY MEDICAL PERSONNEL

<i>Telemedicine activity (last 4 months)</i>	<i>Physicians (n = 7) (Mdn)</i>	<i>Nonphysicians (n = 7) (Mdn)</i>
Telemedicine patients seen (TMED)	60	85
Total patients seen (TMED + non-TMED)	900	200
Telemedicine ratio (TMED/TMED + non-TMED)	7%	43%

Satisfaction with telemedicine

All personnel reported consistently favorable attitudes toward telemedicine across all types of questions, shown in Table 7. They rated their attitudes on a 5-point scale, with more positive attitudes indicated by lower scores (see Methods). Nonphysicians reported only slightly more favorable attitudes than did physicians. Although the size of this trend was small, it was seen for each of the four attitudinal variables (technologies, modality, usefulness, and perception). Each of the four attitudinal variables consisted of five to seven different questions. Nonphysicians reported more favorable attitudinal scores on the majority of questions.

For example, when answering questions about their satisfaction with different technologies, the nonphysicians indicated greater satisfaction than physicians on five of the seven technologies. In particular, nonphysicians were more satisfied than physicians with the Referral Management System and videoconferencing. Both physicians and nonphysicians had equally favorable ratings for store-and-forward and Internet.

Responding to questions about satisfaction with specific modes of transmitted information, nonphysicians rated three of the five modes higher than did the physicians. The differential between the two groups was particu-

larly evident in reactions to sound and video images. Both groups were undecided on satisfaction with faxed images. However, the physicians tended to be more satisfied with e-mailed images than nonphysicians.

DISCUSSION

These results support several conclusions. First, the ENT teleconsultations had substantial impact on diagnosis. Nearly half of these teleconsultations led to a change in diagnosis by the ENT specialist at San Diego relative to the initial diagnosis by the primary provider at the remote site. Importantly, this finding does not vary by type of ENT condition, patient demographics, and medical facility site. Second, medical personnel in the TRICARE Region 9 had considerable telemedicine experience and reported generally positive attitudes toward the telecommunications technologies in general and the telemedicine process. Third, nonphysicians had slightly more positive attitudes about telemedicine than did the physicians. This was an interesting finding, but it is not reliable, given the small sample size.

Clinical impact

It seems unlikely that the telemedicine process itself (e.g., VC) confounded the ENT ex-

TABLE 7. TELEMEDICINE ATTITUDE SCORES REPORTED BY MEDICAL PERSONNEL

<i>Telemedicine attitudes</i>	<i>Physicians (n = 8) (M)</i>	<i>Nonphysicians (n = 7) (M)</i>
Satisfaction with telemedicine technologies	1.8	1.7
Satisfaction with modality quality	2.1	1.9
Usefulness of telemedicine technologies	1.6	1.5
Perception of telemedicine/healthcare	2.0	1.7

Lower attitude scores indicate more positive attitudes.

aminations and caused the specialist to change the diagnosis. The essential portions of the ENT examinations required viewing video images from endoscopy cameras to examine interior of ear, nose, and throat. This information would be the same for "in-person" or telemedicine. Previous studies have established high reliability between ENT telemedicine and "in-person" examinations.^{20,24} Medical personnel, including the lead ENT specialist, rated video quality very highly. Finally, the patients were presented by trained medical personnel using standardized protocols. Therefore, it is reasonable to use diagnoses via VC as the "gold standard," as is standard practice in Region 9, and that differences in diagnosis in the present study reflect the patient's condition, not the mode of consult. For this reason, no "in-person" control was included in the present study.

Forty-five percent of ENT consultations led to a change in diagnosis. This finding validates the substantial rate of diagnosis change (49%) reported in the initial study of TRICARE Region 9 telemedicine.¹¹ The data in the previous study were difficult to interpret because of missing observations, which could have biased the observed rate in diagnosis change. The present study provided a complete and continuous sample of ENT consultations during a planned 4-month period. Nonetheless, the present study was limited to only diagnoses and not outcomes.⁴ Unfortunately, these data were unavailable in the database. Hopefully, a follow-up study will detail the clinical impact of these ENT teleconsultations.

Several questions arise for further research. Will present telemedicine procedures be cost effective aboard ships? This question is especially pertinent because the types of ENT problems in this study (allergies, sleep-related) could influence shipboard operational efficiency. Upper respiratory conditions and allergies may be a special concern for small ships, due to the restricted environments on these vessels.¹⁶ Some consultations (e.g., tonsillitis-related) could determine the need for surgery and evacuation. Will the evaluation of consultations similar to those in this study, conducted by other ENT specialists, extend the generality of the present findings? Why did some consultations lead to a change in diagnosis while

others did not? Is it possible to decrease the rate of referrals based on the educational impact of the consultation process for primary providers? Will increased exposure to specialty consultations by the primary providers who generate the consults (e.g., GMO, IDC) lead to improved diagnostic skill?

Attitudes and telemedicine experience

The interviews with medical personnel revealed generally favorable attitudes toward telemedicine technologies and the telemedicine process. Other telemedicine studies have frequently reported similar positive findings. It was suggested this may be a measurement problem, namely that patients and providers were not asked critical questions.²⁵

The present questionnaire instrument was designed to include critical questions. The ratings of medical personnel were less favorable in response to some of these questions, such as "Is the quality of care rendered through the use of telemedicine inferior to that provided in person?" Other questions that drew less favorable responses were related to satisfaction with audio and video and image quality transmitted by fax.

Because the more critical questions did produce less favorable ratings, the overall positive trend appears to reflect actual satisfaction with telemedicine rather than a measurement bias. Also, the trend for physicians and nonphysicians to show different patterns of response suggests that the survey instrument had some predictive validity. This study has addressed several internal validity issues. Although, these data were not statistically significant both reliability and validity of the survey instrument were plausible. Further research is indicated, however, to rule out bias.

The interviews showed that medical personnel, particularly physicians, were concerned that telemedicine might compromise patient care in some ways relative to in-person treatment. In contrast, most of them agreed that telemedicine would optimize overall care for patients.

ENT teleconsultations in TRICARE Region 9 clearly profited from a functional infrastructure, namely the telemedicine coordinator,

medical personnel, and RMS technology. One key element was the continuity of personnel, such as the lead ENT specialist, during the past few years. This continuity provided the time and expertise to work through problems with new technology.

Physician and nonphysician telemedicine profiles

Analysis of interviews contrasted physician and nonphysician medical personnel. A small but consistent pattern of differences between these two groups emerged. Nonphysicians reported a higher rate of telemedicine use than the physicians during the present study period. This higher rate was due to the fact that the nonphysicians often presented patients and executed the telemedicine sessions for a referring provider.

CONCLUSIONS

The present results suggest that ENT telemedicine can have a substantial clinical impact in military populations treated at remote sites. Nearly half of the sessions studied (45%) resulted in a change of diagnosis. This finding did not vary by age, gender, military status, ENT conditions, or treatment facilities. In addition, the medical personnel reported very favorable attitudes toward telemedicine technologies and the telemedicine process. Thus, it may be worth investigating the possibility of utilizing ENT telemedicine for shipboard medical departments. Substantially reducing the incidence of ship-to-shore medical evacuations could significantly impact operating costs, despite the cost of telecommunication bandwidth requirements.⁶

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REFERENCES

1. Patel TG. Statement of requirement for research on the effect of enhanced telecommunication for shipboard medical departments (Department of Navy Memorandum: Bureau of Medicine and Surgery, Commanding Officer). Bethesda, MD: Navy Medical Research and Development Command, 1994.
2. Stoloff PH, Garcia FE, Thomason JE, Shia BA. A cost-effectiveness analysis of shipboard telemedicine. *Telemed J* 1998;4:293-304.
3. Vidmar DA. The history of teledermatology in the Department of Defense. *Adv Mil Dermatol* 1999;17:113-124.
4. Walters TJ. Deployment telemedicine: The Walter Reed Army Medical Center Experience. *Mil Med* 1996;161:531-536.
5. Cubano M, Poulouse BK, Talamini MA, Stewart R, Antoszek LE, Lentz R, Nibe R, Kutka MF, Mendoza-Sagaon M. Long-distance mentoring: A novel tool for laparoscopy aboard the USS ABRAHAM LINCOLN. *Surg Endosc: Ultrasound Interven Tech* 1999;13:673-678.
6. Nice S. U.S. Navy medical communications and evacuations at sea. *Mil Med* 1987;152:446-451.
7. Bashshur RL, Reardon TG, Shannon G.W. Telemedicine: a new health care delivery system. *Annu Rev Pub Health* 2000;21:613-637.
8. Jerome LW, DeLeon PH, James LC, Folen R, Earles J, Gedney JJ. The coming of age of telecommunications in psychological research and practice. *Am Psychol* 2000;55:407-421.
9. Sinha A. An overview of telemedicine: The virtual gaze of healthcare in the next century. *Med Anthropol Q* 2000;14:291-309.
10. Health Resources & Services Administration. *Exploratory evaluation of rural applications of telemedicine* (report by the Office of Rural Health Policy, Health Resources & Services Administration). Rockville, MD: U.S. Department of Health and Human Services, 1997.
11. Melcer T, Crann B, Hunsaker D, Deniston W. A retrospective evaluation of the development of a telemedicine network in a military setting. *Mil Med* 2002; in press.

12. US Navy Online. Internet access at www.navy.mil, accessed March, 20 2001.
13. Larson GE, Burr RG, Pearsall DM, Silva J. *An evaluation of the clinical effectiveness of telemedicine: medical providers perspective* (NHRC Rep. No. 98-13). San Diego, CA: Naval Health Research Center, 1998.
14. Brender J, Nohr C, McNair P. Research needs and priorities in health informatics. *Int J Med Informat* 2000;58:257-289.
15. Roine R, Ohinmaa A, Hailey D. Assessing telemedicine: a systematic review of the literature. *Canad Med Asso J* 2001;165:765-771.
16. Blood CG, Griffith DK. Ship size as a factor in illness incidence among U.S. Navy vessels. *Mil Med* 1990;155:310-314.
17. D'Alessandro DM, D'Alessandro MP, Hendrix JC, Bakalar RS. Information needs of naval primary care providers and patients at sea. *Mil Med* 1999;164:127-131.
18. Derderian BR, Blood CG. *Shipboard medical admissions during peacetime and combat support deployments* (NHRC Rep. No. 98-30). San Diego, CA: Naval Health Research Center, 1998.
19. Blakeslee DB, Grist WJ, Stachura ME, Blakeslee BS. Practice of otolaryngology via telemedicine. *Laryngoscope* 1998;108:1-7.
20. Sclafani AP, Heneghan C, Ginsburg J, Sabini P, Stern J, Dolitsky JN. Teleconsultation in otolaryngology: Live versus store and forward consultations. *Otolaryngol Head Neck Surg* 1999;120:62-72.
21. Karp WB, Grigsby RK, McSwiggan-Hardin M, Pursley-Crotteau S, Adams LN, Bell W, Stachura ME, Kanto WP. Use of telemedicine for children with special healthcare needs. *Pediatrics* 2000;105:843-847.
22. Nickelson DW. (1998). Telehealth and the evolving healthcare system: Strategic opportunities for professional psychology. *Prof Psychol Pract* 1998;29:527-535.
23. Dillman D. *Mail and telephone surveys: The total design method*. New York: John Wiley & Sons, Inc., 1978.
24. Stern J, Heneghan C, Sclafani AP, Ginsburg J, Sabini P, Dolitsky JN. Telemedicine applications in otolaryngology. *J Telemed Telecare* 1998;4:74-75.
25. Whitten PS, Mair F. Telemedicine and patient satisfaction: Current status and future directions. *Telemed J e-Health* 2000;6:417-424.

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REPORT DOCUMENTATION PAGE

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14. ABSTRACT (maximum 200 words) This study evaluation telemedicine use in remote military treatment facilities (MTFs) ashore over a 4-month period to help guide telemedicine applications for shipboard medical departments. A prospective study design was used to evaluate specialty care provided by an ear/nose/throat (ENT) physician via videoconference (VC) for patients at remote MTFs in TRICARE Region 9. The study provided a complete and continuous sample of ENT consultations during a planned 4-month period. Data sources included a telemedicine database and telephone interviews to assess attitudes of physician and nonphysician medical personnel. A total of 193 VC consultations (hereafter referred to as teleconsultations) were conducted following referrals from primary provides. Patients were mostly young, male, active duty personnel. Forty-five percent of the 193 teleconsultations resulted in changed diagnosis by the ENT specialist relative to initial diagnosis by the referring provider. This rate of clinical impact was substantial and it generalized across various ENT conditions, demographics, and MTFs. Medical personnel reported generally positive attitudes about telemedicine technologies and the telemedicine process in TRICARE Region 9. Nonphysician providers reported slightly more favorable attitudes compared to physicians. These results suggest that ENT telemedicine has substantial clinical impact in the military populations treated at MTFs. A high rate of changed diagnoses (45%) was observed across age, gender, military status, ENT conditions, and treatment facilities. Medical personnel reported positive attitudes about using the telemedicine system. These results support the use of telemedicine in shipboard medical departments.					
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