Original Research

Teleconsultation for Cardiac Patients: A Comparison Between Nurses and Physicians: The SHL Experience in Israel

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ABSTRACT

The absence of randomized studies on sufficiently large patient cohorts precludes the drawing of any firm conclusions on the comparative performance between nurses and physicians in transtelephonic triage and consultations and in diagnostic and management decision-making. We conducted such a comparative study at the SHL telemedicine facility. This facility also provides face-to-face medical management for its subscribers by means of mobile intensive care units (MICUs) staffed by physicians. The outcome of calls that came between 7:00 AM and 11:00 PM throughout the study year and that were handled at random by specially trained physicians (n = 15) or nurses (n = 35) were analyzed. Of 48,707 subscribers who fulfilled the study entry criteria 25,106 used the service at least once, producing 88,103 calls (81,817 handled by nurses and 6,286 by physicians). Teleconsultations were sufficient for most of the cases (80.13%). There were no significant differences between the performance of nurses and physicians regarding demographics (age, gender) and medical diagnoses of the applicants. The nurses’ performance and decisions were comparable to those of physicians with respect to teleconsultations, medically justified dispatches of an MICU, repeated calls to the center and mortality during the week after the index call, although the duration of the physicians’ telephone consultations was longer. Delegation of equal authority to nurses and physicians in triage and consultation in telecardiology results in equivalent and highly satisfactory medical care in a system in which subscribers receive service orchestrated from a single center of telecommunications.

INTRODUCTION

Advances in telecommunication technologies used in healthcare over the last decade have greatly expanded the possibilities of its application to a variety of services. In addition to remote monitoring of vital signs, home health agencies now provide diverse systems for palliative care (hospice), rehabilitation, case management, chronic disease management, “virtual” house calls, postsurgical follow-up, and more. People are living longer than ever before in history, are better educated and more comfortable with the use of these

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new technologies. Most individuals want to remain independent and live in their own homes for as long as possible, even though more and more members of our aging society suffer from chronic conditions. While critical shortages of public resources force healthcare providers to do more with less, consumer expectations for quality care and enhanced clinical outcomes continue to rise unabatedly. It is, therefore, not surprising that experts have recommended greater involvement of home health services in the care of patients with chronic disease.1–4 This recommendation is based on a number of considerations, among which is the presumption that home healthcare nurses will reduce hospitalization rates by educating patients, increasing patient compliance, detecting clinical deterioration and even decreasing costs to health providers.5–8

The concept of nurse practitioners is well developed in the United States and has begun to spread to other Western countries as well. In the United Kingdom, for example, nurse practitioners are being increasingly used as the first points of contact in primary care. Several authors have reported that physicians and nurses perform equally well in triaging patient visits to their clinics,9–13 and that each group taken separately is efficacious in performing transtelephonic triage,14,15 and consultations16,17 as well as in making diagnostic and management decisions.18,19 In-depth comparisons between the performance of physicians and nurses, however, are few, and the ones that are available involve small numbers of participants. Our search of the literature failed to elicit any randomized studies in sufficiently large patient cohorts to draw any firm conclusions.

SHL is a telemedicine system currently serving over 65,000 subscribers. As part of SHL’s ongoing self-assessment, we wanted to confirm that our policy of equal delegation of authority to nurses and physicians in triage and consultation was in the best interests of our patients. To that end, we conducted this study to evaluate the decisions taken by nurses compared to those taken by physicians in the same setting of this telemedicine system that employs a relatively large professional staff to serve a very large patient population.

**MATERIALS AND METHODS**

**The system**

The medical facility SHL, which incorporates telediagnostic and face-to-face professional medical assistance to its subscribers throughout Israel and the Jordanian West Bank territories, has been in operation since 1987 and has been described in detail elsewhere.20–23 Briefly, SHL operates 24 hours per day, 365 days per year through a monitoring center managed by specially trained registered and/or intensive care nurses who are authorized to dispatch mobile intensive care units (MICUs) staffed by physicians and paramedics to subscribers living within a radius of 30 km of the cities of Tel-Aviv and Haifa. In the event that an SHL MICU is not available or when the call originates from areas beyond SHL’s MICU catchment area, an MICU from MDA (the Israeli Red Shield) or a regular MDA ambulance (i.e., without a physician in attendance) is dispatched.

Subscribers (predominantly cardiac patients) as well as healthy individuals (Table 1) learn about the system through advertisement and arrive independently or are referred by their physicians or other treating medical staff (home for the elderly, etc.).

Each subscriber’s complete medical file, which also includes a full 12-lead electrocardiogram, is stored in a central computer and

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>(%)</th>
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<tbody>
<tr>
<td>Past myocardial infarction</td>
<td>24</td>
</tr>
<tr>
<td>Anginal syndrome (any class)</td>
<td>23</td>
</tr>
<tr>
<td>Dysrhythmia (tachybrady arrhythmia paroxysmal and/or chronic)</td>
<td>15</td>
</tr>
<tr>
<td>Chronic conduction disturbances</td>
<td>15</td>
</tr>
<tr>
<td>Poststatus any cardiac surgery</td>
<td>11</td>
</tr>
<tr>
<td>Poststatus coronary angioplasty</td>
<td>10</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>8</td>
</tr>
<tr>
<td>Postcardiopulmonary resuscitation</td>
<td>2</td>
</tr>
<tr>
<td>Pacemaker/AICD</td>
<td>2</td>
</tr>
<tr>
<td>Noncoronary heart disease</td>
<td>9</td>
</tr>
<tr>
<td>Coronary risk factors only</td>
<td>28</td>
</tr>
<tr>
<td>None of the abovea</td>
<td>27</td>
</tr>
</tbody>
</table>

aIncluding individuals who were ostensibly healthy and entirely symptom-free.

AICD, automatic implantable cardioverter defibrillator.
the records are continuously updated. All the members carry a cardiobeeper by which they can transmit a 3- (I, II, III) or 12-lead electrocardiogram via a regular household or cellular telephone. Once a name or identification number identifies the caller, the appropriate medical file is immediately displayed on a computer screen from which the nurse or physician retrieves all the pertinent facts in addition to taking a real-time transtelephonic anamnesis. After interpreting the newly transmitted electrocardiographic data, and based on the integration of written protocols, computerized algorithms and her/his clinical judgment, the nurse/physician may either dispatch an SHL MICU, an MDA MICU or ambulance, or instruct the patient according to the established medical or behavioral protocol. If it is the nurse who answers the call, he or she may consult with the physician who is either present at the center or on-call. He or she is permitted to recommend over-the-counter medications or those used regularly by the patient, but not new drugs.

The staff is capable of handling calls in Hebrew, Arabic (Israel’s second official language), Russian, and English.

Staff training

In order to be accepted as a staff member at SHL, both physicians and nurses must take a written examination to evaluate their expertise in straightforward common cardiological issues, in the interpretation of case studies, in the identification of life-threatening situations, and in the fields of electrocardiography and pharmacology (the latter with special emphasis on cardiovascular drugs). The candidates who meet the stringent requirements are interviewed by two experienced senior physicians in order to assess their suitability (in terms of their character) for working in this special setting. The ones who pass these tests are interviewed by the chief cardiologist, and specific gaps in their knowledge as revealed by earlier tests are addressed. The candidates who are found to need it undergo SHL’s 160-hour course on executing and interpreting electrocardiograms. The final stage of training involves 200 hours of hands-on experience in the monitor center under close supervision of a personal instructor (an experienced nurse) and 60 hours with the MICU team in the field. It is during this period that the trainee becomes highly familiar with all of the SHL protocols and standing orders.

Continuing education and quality assurance

A staff meeting takes place every month for physicians and every 3 months for nurses with the purpose of analyzing and addressing new issues and orders, case studies and updates. All calls to and from the monitor center are recorded, and at least 2–3 times per year three calls are chosen at random for each staff member for analysis by the medical management (3 physicians [including 1 cardiologist], 1 head nurse and 1 operational manager) who listen to the calls and professionally assess the way they were handled. The staff member is then informed about the quality of his/her judgment and actions, and these remarks are added to his/her personal file for comparison with the next analysis.

Study period and patient population

After administrative and other miscellaneous calls had been screened out, all medical calls to the monitor center between January to December, 2003 were reviewed for this study. Only calls that came in between 7:00 AM and 11:00 PM were included because those were the hours when physicians who triaged patients were present at the monitor center.

DESIGN

Neither the nurses nor the physicians were aware that their performances were being compared. The outcomes of all their teleconsultations were assessed with respect to the subscribers’ medical history that had been retrieved from their medical files. The end points for comparison and characterization were as follows.

Teleconsultations

These included all calls that were concluded on the telephone without any additional mea-
sures, all calls which resulted in an additional teleconsultation(s), and all calls that resulted in the dispatch of an SHL MICU.

**Justified dispatches of a MICU**

All dispatches of a SHL MICU that resulted in the subscriber’s being transported to the emergency department of a hospital or in the necessity for emergent or any medical treatment on the scene were considered as being “justified.” Of these, the ones in which the patient needed to be taken to the hospital were classified as first order (Type A) justified calls, while the ones in which the dispatch concluded with treatment of any kind at the scene (including as little as the administration of an oral tranquilizer) were considered as being second order (Type B) justified calls.

**Unjustified dispatches of an MICU**

All dispatches of an SHL MICU in which the examining physician left the patient at home without any treatment or suggestion apart from the recommendation to call the center again in case of the reappearance or aggravation of symptoms were considered as having been unjustified.

**Follow-up**

Data on additional application(s) to the SHL monitor center and on mortality during the week after the index call to the center as well as the result of dispatches handled by SHL’s MICUs were retrieved. Because information on the outcome of dispatches by other than SHL staff members could not be completely documented, only those dispatches treated by the SHL team were included in the final analysis. Mortality data could, however, be obtained from relatives who called SHL to cancel the subscription of deceased members.

**Statistical analysis**

Data were downloaded from the database of subscriber calls to the SHL center and transferred into the Statistical Package for the Social Sciences (SPSS, Chicago, IL) for analysis. Results are given as mean ± standard deviation (SD) for continuous variables, such as staff members’ working experience, and as numbers plus percentages for all dichotomous variables, such as gender, justified dispatches, etc. The \( \chi^2 \) analysis was used to compare the different variables between nurses and physicians. A \( p \) value <0.05 was considered statistically significant in the analyses of the results.

**RESULTS**

**General**

During the study period, 48,707 subscribers fulfilled study entry criteria and their main cardiac diagnoses are displayed in Table 1. There were 26,799 (55%) males, and the age distribution of the cohort was 47% who were 61–80 years of age; 2%, 40 years or less; 25%, 41–60 years; and 26%, 81 years or older. During the study period 25,106 subscribers (52%) called the center at least once and 1 patient called 815 times. The breakdown of the frequency of calls is shown in Table 2.

The SHL medical staff that participated in the study consisted of 35 registered nurses with professional experience of 84 ± 60 months (range, 6–199 months) and 13 physicians with professional experience of 56 ± 38 months (range, 18–139 months).

**Teleconsultations and triage**

A total of 154,796 telephone calls consisting of teleconsultations or the dispatching of an

<table>
<thead>
<tr>
<th>No. of calls/year</th>
<th>Subscribers (n = 48,707)</th>
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<tbody>
<tr>
<td>0</td>
<td>23,601 (48%)</td>
</tr>
<tr>
<td>1</td>
<td>9,862</td>
</tr>
<tr>
<td>2</td>
<td>5,252</td>
</tr>
<tr>
<td>3</td>
<td>3,046</td>
</tr>
<tr>
<td>4</td>
<td>1,904</td>
</tr>
<tr>
<td>5</td>
<td>1,274</td>
</tr>
<tr>
<td>6–10</td>
<td>2,438</td>
</tr>
<tr>
<td>11–20</td>
<td>932</td>
</tr>
<tr>
<td>21–30</td>
<td>203</td>
</tr>
<tr>
<td>31–40</td>
<td>65</td>
</tr>
<tr>
<td>41–50</td>
<td>61</td>
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<td>51–75</td>
<td>47</td>
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<tr>
<td>76–100</td>
<td>20</td>
</tr>
<tr>
<td>101–200</td>
<td>19</td>
</tr>
<tr>
<td>201–600</td>
<td>8</td>
</tr>
<tr>
<td>815</td>
<td>1</td>
</tr>
</tbody>
</table>
MICU or ambulance were recorded throughout 24 hours per day during 2003, including those of subscribers without known or documented cardiac disease. Of these, 94,169 calls came in between 7:00 AM and 11:00 PM and were handled randomly by either nurses or physicians (whoever was available and picked up the telephone).

All calls flagged with a standing order for physician consultation only or for mandatory dispatch of an MICU (e.g., direct admission requested by the subscriber’s private physician) were excluded. This left a total of 88,103 calls of which 81,817 were handled by nurses (average, 2,338 each) and 6,286 by physicians (average, 484 each).

Telephone consultations lasted 6.88 ± 6.98 minutes for nurses and 8.97 ± 6.88 minutes for physicians ($p < 0.001$). Those calls that ended with an MICU dispatch tended to be a little longer for both nurses and physicians.

There were no significant differences between the calls handled by nurses or physicians in terms of the patient’s age, gender, distribution of medical diagnoses, or the hour at which the call was received.

### Dispatches

A dispatch of an MICU (SHL’s or other) or a regular ambulance resulted from 19.87% (17,502/88,103) of the calls, while the remaining 70,601 (80.13%) calls ended in teleconsultations alone. Overall, nurses tended to dispatch MICUs slightly more than physicians (in 19% of the calls compared with 18%, respectively, $p = 0.073$). An SHL MICU was dispatched in the majority of cases (approximately 70%, 12,150 calls) of which 69.3% (8,423/12,150) were considered justified dispatches. Nurses dispatched more justified cases (67%) than physicians 64% ($p = 0.049$). A comparison between nurses and physicians for type of dispatch revealed that 50% of all the nurses’ dispatches and 45% of all the physicians’ dispatches were “Type A” ($p < 0.001$) while 20% of all the physicians’ dispatches and 17% of all the nurses’ dispatches were “Type B” ($p < 0.01$). Transportation to the hospital followed the MICU team’s on-the-scene treatment for 41% of the nurses’ dispatches compared with only 35% of the physicians’ dispatches ($p < 0.001$).

No correlation was found between the extent of the nurses and physician’s professional experience and their tendency to dispatch an MICU.

### Follow-up

Of the total number of calls, 29% (25,865/88,103) called again (by request or from their own initiative for reassurance) within 24 hours from the index call. Of these, 29% (23,817/81,817) were calls that had originally been handled by nurses compared with 33% (2,048/6,286) handled originally by physicians ($p < 0.001$).

Of the 70,601 calls that ended with teleconsultations, a dispatch was required during the following week in 9.08% of those handled by nurses and in 9.88% of those handled by physicians, with a subsequent mortality of 0.03% and 0%, respectively. None of these differences reached a level of statistical significance ($p = 0.25$).

### DISCUSSION

Telephone consultation is becoming an increasingly accepted approach to patient care and was shown to improve public access to medical information and advice. Despite the rapid advances and dissemination of information technologies in our daily life, however, the use of telemedicine remains restricted rather than being widely deployed. Moreover, even recent systematic reviews of telemedicine, some addressing specific outcomes (e.g., impact on clinical decision making and clinical outcomes, patient satisfaction, and cost effectiveness), have provided disappointingly little information about when telemedicine applications are practical and when they are not. One of the concerns may involve the ability of nurses to use telemedical applications for appropriately triaging patients.

While the ability of nurses to triage patients in stand-alone clinics or independently but still under the roof of colleague or partner physicians is well documented, we believe the present study to be the first to show that the capabilities of well-trained nurses to triage
and consult through the telephone are comparable to those of physicians. This investigation was done on a large population of patients who were handled at random by physicians and nurses who were unaware that their decisions were being studied and compared. The SHL system has the advantage that applicants are not anonymous and that each subscriber has a fully updated medical record, thus providing essential information to the "triager," compared to one who has to make decisions for a completely anonymous patient.

We did not attempt to compare the clinical effectiveness of telemedicine with standard healthcare methods nor the diagnostic accuracy of the system versus conventional diagnostic methods. Nevertheless, our results are in accordance with those of others and provide more evidence for the utility of teleconsultation in cardiology.8,15 Noteworthy, the attitudes of patients towards the use of telemedicine have been measured by many authors, with most reporting high levels of satisfaction and a willingness to use telemedicine in the future.24,25,27

We, as others found that a large proportion of calls (about 80%) can be handled with advice alone.6 In contrast to studies that compared physicians and nurse’s face-to-face consultations and reported on longer consultation time for nurses,10,18,27 our experience was the opposite: the physicians’ consultations lasted significantly longer than those of the nurses (8.97 ± 6.88 minutes versus 6.88 ± 6.98, respectively, p < 0.001). Although it is tempting to attribute the longer consultation time for physicians to an element of uncertainty, we suspect that the reason lies in their being less experienced with the computer software compared to the nurses.

Ten years ago, an anonymous editorial in The Lancet stated, “Although much is claimed, the economic benefits of telemedicine have yet to be proved.”28 It was beyond the scope of this paper to address economic issues, but our demonstration of nurses’ triage capabilities shows promise in the system for reducing costs without jeopardizing patients’ health, especially in those areas that lack sufficient numbers of physicians or where a nurse’s salary may be lower than a physician’s. It should also be taken into account that telecardiological services may be easier to apply than for other fields because it relies heavily on analyzing information from a patient’s background and history in assessing the patient’s condition, in addition to a reliable electrocardiographic transmission and a reliable electrocardiographic transmission that does not need ultrasound and image capture and resolution devices as in other fields of telemedicine (i.e., telediagnosis, telepathology, teledermatology, etc.).

Finally, an important factor for the success of any telecardiological program is the training of the staff. Nurse practitioners are increasingly used as the point of first contact in primary care, and observational studies have suggested that patients react positively to the use of nurse practitioners.27 As a result, the number of trained nurse practitioners is increasing as dedicated training programs become more accessible and quality assurance is established to monitor their effectiveness.13–15,29

Our findings have demonstrated that equal delegation of authority to nurses and physicians in triage and consultation in telecardiology results in equivalent and highly satisfactory medical care to the subscribers of the system. The fact that the services are orchestrated from a single center of communications means that the system can quickly reach both surrounding and remote rural areas as long as a telephone line is available.

ACKNOWLEDGMENT

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DISCLAIMER

Dr. Roth is a medical consultant of SHL Medical Services.

REFERENCES


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