The Impact of Telemedicine on Quality of Life in Rural Areas: The Extremadura Model of Specialized Care Delivery

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Abstract

Background: *Referrals from rural health centers to urban hospitals join waiting lists as outpatients for hospital admission and hospital treatment. This influences quality of life (QoL) of the rural population and retired people who require medical attention without traveling, provided no risks are involved. For this reason, a rural region of Spain has adopted a strategy to deliver telemedicine (TM) specialized care (Extremadura model) as a political decision.* ***Objectives:*** *The present study aimed at objectively assessing QoL on aspects of health and well-being for citizens benefiting from this system.* ***Methods:*** *We performed a randomized study of 800 primary care patients referred for specialized care: 420 regular face-to-face hospital referrals and 380 referred to a hospital specialist at a distance by TM. The study used two questionnaires: a modified version of the classical SF-12v2™ short form questionnaire for health and well-being and a specific author-elaborated questionnaire. The latter focused on major patient concerns such as (1) discomfort and pain relief, (2) swift diagnosis, (3) swift treatment, (4) swift decision on hospital admission or not, (5) avoidance of traveling, (6) avoidance of red tape, and (7) personal attention. QoL was assessed twice: before referral to a hospital specialist and 6 months after referral to the same. The results were statistically compared.* ***Results:*** *Both groups showed comparable health status with added advantages for TM referrals such as (1) less traveling ($p = 0.0001$) and (2) faster diagnosis, health examination, and treatment ($p = 0.0001$).* ***Conclusion:*** *Telemedicine care by a hospital specialist through videoconferencing was comparable to hospital referral for face-to-face medicine. Teleconsultations managed by nurses had a positive impact on the QoL of rural patients. They did not have to travel and thus diagnoses and examinations to start treatment were initiated faster.*

Key words: *primary care, secondary care, tertiary care, telemedicine, quality of life, rural medicine*

Introduction

Most rural areas are characterized by isolated, elderly populations and wherein the cost-benefit of introducing new technology is difficult to assess, because the classical items such as loss of working time refer to younger people and are often not directly relevant.

In terms of health, elderly rural people are highly concerned about (1) relief from pain and discomfort, (2) swift diagnosis, (3) swift treatment, (4) swift decision on hospital admission or not, (5) avoidance of traveling/leaving home, (6) avoidance of red tape, and (7) personal attention when entering the healthcare system.

In general, when a general practitioner refers a patient to a hospital for specialist attention, the intervention is delayed due to waiting lists, first for the outpatient appointment, second for hospital admission when necessary, and finally for diagnostic procedures and treatment.

The factors influencing quality of life (QoL) in rural areas are health needs, including health-related costs. In fact, the major reason behind patients opting out of the public healthcare system is the need for immediate attention, which includes overall waiting time, degree

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of health problems/discomfort, and financial or time costs related to hospital traveling, among others.

Given these considerations, it seems reasonable to implement telemedicine (TM) solutions to improve the QoL of these people. This is consistent with the goals of health services research whose strategies consider how social factors, financial systems, organizational structures and processes, health technologies, and personal behaviors affect access, quality and cost of healthcare, and health and well-being of citizens. Three levels are involved in an appropriate evaluation: (1) the macrolevel (regional, national, or international healthcare system), as in the present case; (2) the microlevel for the interaction between patients and providers; and (3) the mesolevel for healthcare organizations and services, as in disease management programs. Health technology innovations require Health Technology Assessment, which agencies concentrate on microlevel (patients and providers) when evaluating new pharmaceuticals or medical devices including TM.

In the rural region of Extremadura, Spain, the strategy of primary care TM (the so-called Extremadura model) was adopted as a political decision. The purpose of the present study was to objectively asses the QoL, health, and well-being of citizens benefiting from this system.

Patients and Methods

PATIENTS

The primary care area of Badajoz (Extremadura, Spain) has 246,000 inhabitants spread over 6,225 km^2, with a population density of 20.8 inhabitants/km^2, 49% of whom are located in rural areas. Fifty three percent of the rural population have TM facilities. Distances to the nearest reference hospitals are 5–25 km for 10% of the citizens, 25–50 km for 45% of them, and more than 50 km for the remainder.

The study was conducted between October 2007 and November 2008, during which there were 159 health professionals (including 55 physicians and 53 nurses) working in primary care. In all five healthcare areas, nurses were responsible for TM services. In the Badajoz area (4,053 patients) where the study was conducted, there were 747 TM referrals managed by 2 nurses and 23 physicians.

TM referrals from general practitioners or secondary care specialists to the two reference hospitals involved the following specialties: dermatology, traumatology, psychiatry, internal medicine, pain-relief unit, X-ray department, endocrinology, and rheumatology. Physicians usually decided which patient should be seen by a hospital specialist (tertiary care) as an outpatient. In the Extremadura model, the patient decided whether to consult the specialist face-to-face (F2F) or by TM. In four of the above-mentioned specialties (dermatology, traumatology, endocrinology, and rheumatology), 100% of the patients chose to be attended by TM. The F2F consultations joined the outpatient waiting list of the specialty in question.

Telemedicine facilities first started with a pilot study in Badajoz in 2001, followed by a public tender of TM infrastructure in 11 hospitals and 18 healthcare centers in 2002, which evolved to operative implementation in public health in 2003.

Teleconsultations were managed by the nurses using 2 ISDN-videoconferencing systems (Vitel Net Europa, SA, Badajoz, Spain) and Internet for data/image dispatch.

METHODS

This randomized study was performed during 1 year with 800 patients, 420 F2F and 380 TM referrals.

All patients were evaluated at the beginning of the study with the QoL SF-12v2 questionnaire and again 6 months later with a specific TM questionnaire (STMQ). The questionnaires were administered by a single nurse in person and the follow-up questionnaire was completed over telephone.

Enrollment. Due to the widespread use of the TM option, it was difficult to find cases of F2F referrals. Therefore, 78% of F2F referrals were enrolled at the reference hospital during follow-up visits, whereas 22% of them were enrolled in primary care centers.

PATIENT SELECTION

Telemedicine. All 747 TM referrals in the study period were numbered consecutively; 400 were randomly selected, of whom 380 agreed to be included in the study, signing a letter of consent. The second questionnaire at the end of the study was completed by 306 (81%).

Face-to-face. Of 662 randomly selected F2F referrals, 420 agreed to be included, 349 of whom remained at the end of the study period (87%) and completed the follow-up questionnaire. Reasons for noncompletion of the follow-up questionnaire were incorrect telephone number, change of opinion, or not located.

QUALITY OF LIFE

QoL of conventional primary care intervention (F2F) versus the TM intervention was evaluated with the questionnaires summarized in *Tables 1* and *2*, which grouped questions according to categories.

The SF-12 v2 questionnaire (*Table 1*) is a standard QoL questionnaire.[1] The 12 items were grouped in 7 categories (vitality was included in the Mental Health dimension).

Table 1. SF-12 Version 2 Questionnaire (Modified)—Maximum Score Is 50

P1—HEALTH STATUS	SCORE
1. How would you evaluate your health status before referral? 1.1 BIS: How would you evaluate your health status after referral (F2F/TM) treatment?	1,2,3; 4;5
P2—PHYSICAL ACTIVITY	**SCORE**
2. Does your health limit your daily activity? If so, how much? A. Moderate: Moving a table, using a vacuum cleaner, petanca bowling, walking less than 1 h. B. Intense: Climbing several flights of stairs. 2. BIS: After F2F/TM treatment	1,2,3
P3—PHYSICAL LIMITATIONS	**SCORE**
3. Have you had problems in your work or any other regular daily activity? How much of the time? A. Moderate: I have done less then I wanted. B. Intense: I was limited in the activity. 3. BIS: After F2F/TM treatment.	1,2,3; 4;5
P4—PSYCHOLOGICAL LIMITATIONS	**SCORE**
4. Do you have limitations because of an emotional problem? How much of the time? A. Moderate: I have done less than I wanted. B. Intense: I did not do some work or activities. 4. BIS: After F2F/TM treatment	1,2,3; 4;5
P5—PAIN	**SCORE**
5.1 Does the pain limit your daily activity at home or at work? How much? 5. BIS: After F2F/TM treatment	1,2,3; 4;5
P6—MENTAL STATUS	**SCORE**
6. Have you had problems in your work or daily activity? How much? A. Calm: Have you been calm and relaxed? B. Energy: Do you have a lot of energy? C. Depression: Have you felt downhearted and depressed? 6. BIS: After F2F/TM treatment.	1,2,3; 4;5
P7—SOCIAL ACTIVITY	**SCORE**
7. Have your physical health or emotional problems interfered with your social activities? How much? 7. BIS: After F2F/TM treatment.	1,2,3; 4;5

F2F, face-to-face; TM, telemedicine.
The 12 items were grouped in 7 categories. BIS is the second round of answers.

The STMQ (*Table 2*), created by one of the authors (O.F.R.), was designed to test the QoL perceived by the patients after medical interventions. For questions scored on a 4-point scale, rating was as follows: 0, no/none; 1, partially/some; 2, almost/considerable; 3, yes/a lot; and 9, not applicable. Questions regarding time were scored as follows: 0, >4 months; 1, 2–4 months; 2, 1–2 months; 3, <1 month; and 9, not applicable. Questions regarding traveling were scored as follows: 0, <5 trips; 1, 5–10 trips; 2, >10 trips; and 9, not applicable. The STMQ was less clear to patients, and thus some questions were not properly answered.

Answers to the SF-12v2 questionnaire were considered objective, whereas those given in the STMQ were considered subjective.

Table 2. Subjective Telemedicine Questionnaire for Quality of Life

P18—PAIN AND DISCOMFORT	SCORE
18.1 Degree of pain	0,1,2,3
18.2 How do you feel?	0,1,2,3
18.3 Have you improved in everyday home work activity?	0,1,2,3
18.4 Have you improved in outside-home mobility?	0,1,2,3
18.5 Have you improved in self-sufficiency?	0,1,2,3
P19—TIME BEFORE DG/PHYSICAL EXAMINATION	**SCORE**
19.1 Were you diagnosed quickly? (YES/NO)	0,1
19.2 How long was the diagnostic period?	0,1,2,3
19.3 Were you physically examined quickly? (YES/NO)	0,1
19.4 How long was the physical examination period?	0,1,2,3
P20—TIME BEFORE STARTING TREATMENT	**SCORE**
20.1 How long did you have to wait for treatment?	0,1,2,3
20.2 Were you treated quickly? (YES/NO)	0,1
20.3 How long was your treatment?	0,1,2,3 9 not applicable
P21—HOSPITAL ADMISSION	**SCORE**
21.1 Was hospital admission avoided? (YES/NO)	0,1.
21.2 How long did you wait for hospital admission?	0,1,2,3
P22—TRAVELING	**SCORE**
22.1 Has traveling been avoided? (YES/NO)	0,1.
22.2 Were the number of trips less than expected?	0,1
22.3 Specify the number of trips	0,1,2
P23—ADMINISTRATIVE/PAPER WORK EFFORT	**SCORE**
23.1 Was there a lot of paperwork? (YES/NO)	0,1
P24—PERSONAL ATTENTION	**SCORE**
7.1a Was the personal attention you received good?	0,1,2,3 9 not applicable
7.2a Was the time devoted to you sufficient?	0,1,2,3

Best score, 0; worst score, 43. The 20 items were grouped in 7 categories.

Source: Ferrer-Roca O. Specific telemedicine questionnaire on quality of life. 2007.

STATISTICAL EVALUATION

In the case of some questions, answers were fused to reduce groups and improve statistical power.

The nonparametric Kruskal–Wallis test was used to assess significant treatment effects for scale efficacy data. Within-patient treatment efficacy was assessed using the Wilcoxon signed rank statistic. Treatment effects were tested at the $a = 0.05$ level of significance. Categorical efficacy data were analyzed using the chi-squared test with appropriate degrees of freedom.

Correlation was assessed using the Spearman rho rank order test, considered low < 0.5, moderate 0.5–0.6, and high ≥ 0.7; only significant correlations are shown ($p \leq 0.05$).

The reliable change index (RCI) was calculated by subtracting the final score from the initial one. On applying the RCI to the SF-12v2 scores, we obtained what we called Objective Improvement; only Health Status (P1) and Pain (P5) showed changes. On applying the RCI to all STMQ scores, we obtained what we called Subjective Improvement; only Pain (P18.1) and Health Status (P18.2) showed changes.

Statistical evaluation was carried out with the PASW Statistics (prior SPSS, Chicago, IL) http://pasw-statistics-spss.softonic.com, accessed August 30, 2009.

Results

Mean age of the F2F group was 52.7 ± 18.63 years, and the mean age of the TM group was 46.7 ± 19.08 years. Working status is shown in *Figure 1* and overall scores for SF-12v2 are shown in *Figure 2*.

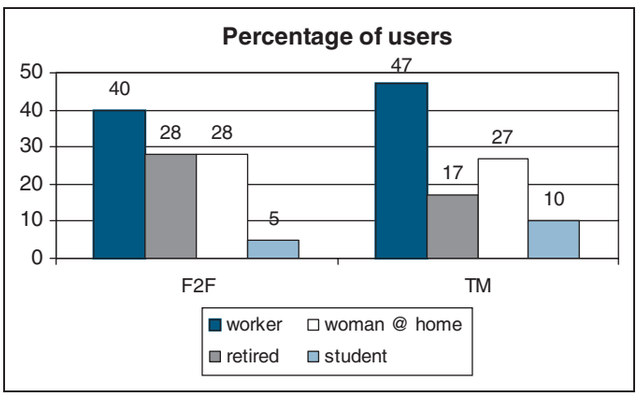

Fig. 1. Patients' activity in the two groups referred face-to-face (F2F) or at a distance by telemedicine (TM).

P1—HEALTH STATUS PARAMETERS

Both groups maintained health status during the study (*Fig. 3*) in spite of the fact that the TM group, in better health at the start ($p = 0.0001$), reached comparable scores 6 months later (*Table 3*).

Subjective Improvement (P18.2) showed no differences between the two groups.

Objective Improvement (final P1 minus initial P1) was greater in F2F-treated cases ($p = 0.0001$). Its dependence on initial healthcare status was moderate and negative (Spearman rho = −0.52) with greater improvement for those with worse initial health status (*Fig. 4* and *Table 4*).

P2-P3—PHYSICAL STATUS PARAMETERS

Physical activity and physical limitation parameters were initially highly correlated (rho = 0.7), becoming identical at the end (rho = 0.93).

There was a moderate dependence on initial pain (P5) (start rho = −0.6), indicating less physical activity with greater pain. This dependence was less evident at the end of the study (final rho = −0.4).

Both groups improved physical status during the study period. In daily activity limitations (P3), there were differences ($p = 0.001$) with TM patients showing greater improvement despite less initial pain (see P5 below).

P4-P6—PSYCHOLOGICAL PARAMETERS

Similarly to the previous section, these two parameters (P4–P6) were moderately correlated at the start and strongly correlated at the end (start rho = 0.55 and final rho = 0.85).

No statistical differences between the two groups were found.

Dependence of psychological parameters was found only with the daily activity limitations parameter (P6 vs. P3) (start rho = −0.50 and final rho = −0.634). No correlation with pain was found.

P5—PAIN

Both groups showed significant variations during the study period (*Table 5*). The trend was for values to be concentrated in the middle region (*Fig. 5*).

Dependence of final on initial pain was lower in the F2F group (Spearman rho = 0.5) than in the TM group (rho = 0.6), the latter entering the study with less pain (*Table 6*).

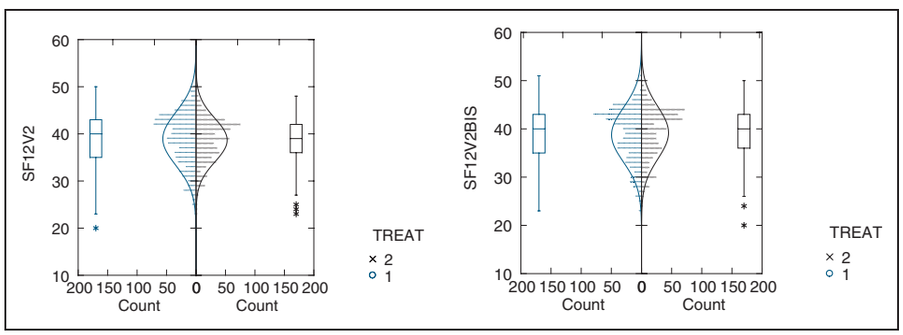

Fig. 2. SF-12v2 global score at the start (left) and after 6 months (right). TM-treated patients in black and F2F-treated patients in blue. Inspite of the improvement of TM score, no statistical significances were found.

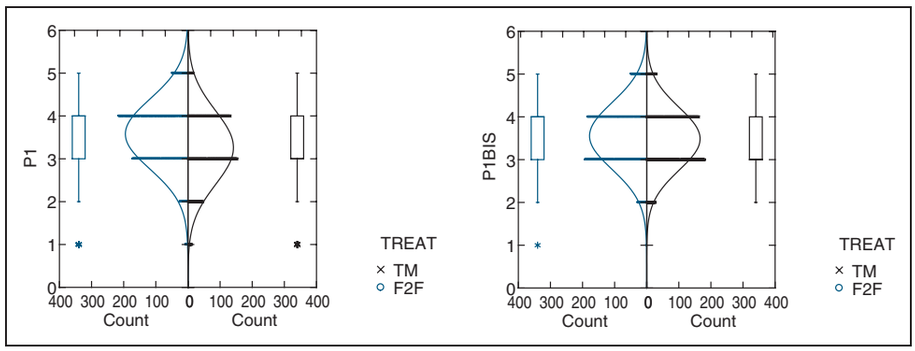

Fig. 3. Health status score at the start (left) and after 6 months (right). TM-treated patients in black and F2F-treated patients in blue. Note the difference of variance at the start.

Pain moderately influenced health status at the beginning of the study (P1 vs. P5) (F2F rho = 0.52 and TM rho = 0.53), increasing its influence at the end of the study (final: F2F rho = 0.60 and TM rho = 0.63).

Differences between Subjective and Objective Improvement were nonsignificant (*Table 7*). Both groups showed minor changes (*Fig. 6*) with less variance in the objective score.

Subjective Improvement (final minus start P18.1 score) was independent of initial pain (P5) (initial rho = −0.27). This trend persisted up to the end for the TM group (rho = −0.26) but not for the F2F group (rho = −0.40) whose higher initial pain scores showed greater improvement.

Objective Improvement (final minus start P5 score) was moderately dependent on initial pain in the F2F group (Spearman rho = 0.61) whose higher initial pain scores also showed greater improvement. The TM group that started with less pain showed a lower dependence (rho = −0.39).

P7—SOCIAL ACTIVITY

Patients, particularly those in the TM group, started with limited social activity that correlated with emotional status (start P7 vs. P4B: F2F rho = 0.6 and TM rho = 0.5).

In both groups, activity improved significantly at the end of the study, reaching comparable QoL scores (*Table 8*). At the end, social activity showed moderate correlation with depression (final P7 vs. P6C: F2F and TM rho = 0.6).

P18.3-P18.4-P18.5—DISCOMFORT

Subjective improvement in home activity (P18.3), outside mobility (P18.4), and self-sufficiency (P18.5) showed a significant Kruskal–Wallis one-way analysis of variance test with a $p = 0.0001$ in the Mann–Whitney *U* test, because the TM group showed higher scores at the end of the study.

P19.1-P19.4-P20.1-P20.2—DIAGNOSIS/PHYSICAL EXAMINATION/TREATMENT

These were subjective parameters related to time required for diagnosis (P19.1), physical examination (P19.4), and treatment (P20). We found a significant Kruskal–Wallis one-way analysis of variance test with a $p = 0.0001$ in the Mann–Whitney *U* test, with better values for the TM group (*Fig. 7*).

The TM group required less than 1 month for all the above variables, as can be seen in *Table 9*, with the not applicable answers being excluded.

Table 3. Health Status

	INITIAL			FINAL		
HEALTH STATUS	F2F	TM	TOTAL	F2F	TM	TOTAL
Good	175 (44%)	180 (59%)	355	170 (49%)	159 (52%)	329
Average	183 (46%)	112 (37%)	295	141 (41%)	124 (41%)	265
Bad	42	14	56	38 (11%)	23 (7%)	61
Total	400	306	706	349	306	655
	Chi-square 18.98; $p = 0.0001$			Chi-square 2.334; $p = 0.311$		

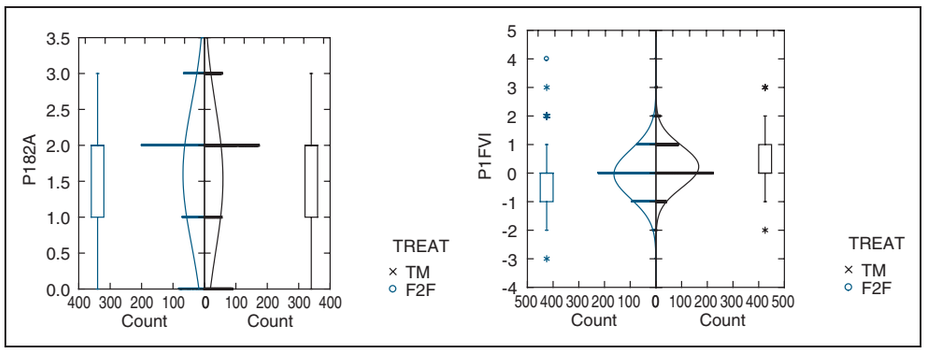

Fig. 4. Health status improvement. Subjective (left) and objective (right) differences. Note the difference of variance in the subjective parameter (negative values indicate greater improvement).

P21.1-P21.2-P21.3—HOSPITAL ADMISSION

All groups showed a significant Kruskal–Wallis one-way analysis of variance with a $p = 0.0001$ for the Mann–Whitney U test, with better values for the TM group.

In the TM group, 97% considered that they avoided hospital admission due to the way medicine was delivered, whereas in F2F patients the proportion was 80% (chi-square 44.1 and $p = 0.0001$).

P22.1-P22.2-P22.3—AVOIDANCE OF TRAVELING

These were subjective parameters related with trip-saving of patients far away from hospitals. All showed a significant Kruskal–Wallis one-way analysis of variance with a $p = 0.0001$ in the Mann–Whitney U test, with better values for the TM group.

In the TM group, 97% of patients made <5 trips, whereas in the F2F-treated patients 50% made <5 trips (chi-square = 166.73 and $p = 0.0001$).

Table 4. Health Status, Subjective Versus Objective Improvement

	SUBJECTIVE IMPROVEMENT—P18.2			OBJECTIVE IMPROVEMENT		
HEALTH STATUS	F2F	TM	TOTAL	F2F	TM	TOTAL
Much better	52 (8%)	45 (7%)	97	89 (26%)	34 (11%)	123
Better	160 (25%)	139 (22%)	299	187	185	372
Unchanged	121 (19%)	115 (18%)	97	73	87	160
Total	333	299	632	349	306	655
	Chi-square 0.3; $p = 0.86$			Chi-square 23.11; $p = 0.0001$		

Table 5. Pain Level

STARTING PAIN	F2F (FINAL PAIN)				TM (FINAL PAIN)			
	LOW	MEDIUM	A LOT	TOTAL	LOW	MEDIUM	A LOT	TOTAL
Low	100	79	8	187	98	64	7	169
Medium	23	47	17	87	21	64	16	101
A lot	7	42	26	75	1	8	27	36
Total	130	168	51	349	349	306	50	306
	Chi-square 70.3; $p = 0.0001$				Chi-square 141.1; $p = 0.0001$			

Evolution from the start to the end of the study in the two groups.

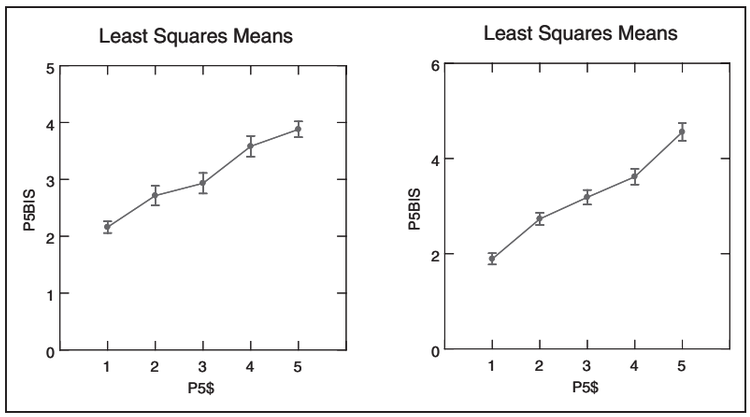

Fig. 5. Pain evolution, start (x) versus final (y) pain. F2F (left) rho = 0.5 and TM (right) rho = 0.6.

Discussion

The present randomized study involved 800 referrals to a hospital specialist located 5–25 km (10%), 25–50 km (45%), or more than 50 km (45%) from home. Specialized care was made available either by hospital traveling (F2F) or by virtual means with TM tools. Both treated groups ended up with comparable health status and QoL evaluated with the classical SF-12 version two questionnaire, but the STMQ demonstrated added advantages for the nontraveling TM referrals that had quicker physical examination, diagnosis, and subsequent treatment ($p = 0.0001$).

As stated in the introduction, health decision makers mainly rely on cost-effectiveness to advise the adoption of a new intervention and they conclude, due to the reduced number of publications, that TM still does not show sufficient evidence.[2]

Table 6. Level of Pain at the Start and at the End of the Study in the Two Groups

	INITIAL			FINAL		
PAIN	F2F	TM	TOTAL	F2F	TM	TOTAL
Low	217 (54%)	169 (55%)	386	130 (37%)	120 (39%)	250
Medium	103 (26%)	101 (33%)	204	168 (48%)	136 (44%)	304
A lot	80 (20%)	36 (12%)	116	51 (15%)	50 (16%)	101
Total	400	306	706	349	306	655
	Chi-square 10.35; $p = 0.006$			Chi-square 0.96; $p = 0.619$		

Table 7. Subjective and Objective Improvement of Pain

	SUBJECTIVE IMPROVEMENT			OBJECTIVE IMPROVEMENT		
PAIN	F2F	TM	TOTAL	F2F	TM	TOTAL
Much better	51 (8%)	47 (8%)	98	88	57	145
Slightly better	143 (23%)	138 (22%)	281	123 (35%)	125 (41%)	248
Unchanged	133 (21%)	115 (18%)	248	138 (40%)	124 (41%)	262
Total	327	300	627	349	306	655
	Chi-square = 0.4; $p = 0.8$			Chi-square 4.59; $p = 0.1$		

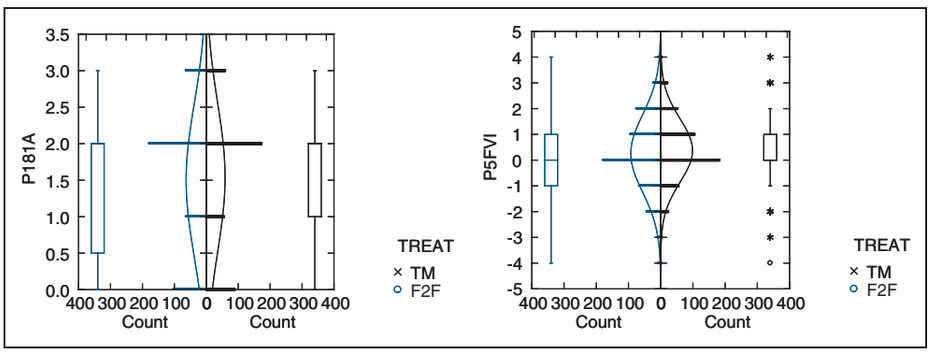

Fig. 6. Pain improvement. Subjective (left) versus objective (right) (negative values indicate greater improvement).

The Extremadura model to deliver hospital specialized care by TM, although not published, was proposed by the European Commission as a model for e-health good practice (http://kb.good-ehealth.org/search.do; entered on 12/03/2008). In our opinion, the following peculiarities are linked to its success: (1) the model was adopted as a result of a top-down decision by regional politicians and is only limited by patient willingness or medical criteria and (2) referral consultations are carried out at primary care centers by nurses. Under these circumstances, the usual resistance on the part of physicians to accept the technology applies exclusively to hospitals, but in this case, the model resulted in less workload. The TM system uses ordinary videoconferencing whose lack of complexity helps reduce TM barriers.[3]

Comparable situations are found elsewhere. In Brazil, the National Health Ministry approved in 2007 of a nation-wide telehealth program in primary care through the Rede Universitaria de Telemedicina, the results of which are still not known.[4] Many published primary care TM trials are home-based and nonrandomized, focusing on family physician or paediatric care.[5] In Hawaii, online TM applications have long been implemented for a range of health projects, but the results have not been published.[6] In contrast, the most extensive published study comes from the MGH-Virtual Project, with only 30 patients.[7]

From the existing publications, it is shown that the main stress is on the human factor in encounters or on technical solutions such as the electronic health record in connection or not with tertiary care hospitals.[8] There is wide consensus that coordination between primary/secondary and hospital care will speed up patient care and reduce readmissions, but not many integrated public health solutions are published.[9,10] Given that 65% of patients admitted to emergency departments have chronic diseases, their treatment at the appropriate healthcare level would avoid overburdening third level hospitals.[11] Further, it becomes essential to make health specialists much more accessible to patients, either through phone-medicine or with complex TM tools.[9,12] One of the more sophisticated published experiences is from National Health Service of Scotland, with 105 emergency department patients connecting with CiscoHealthPresence™ (www.cisco.com/web/about/ac79/health/hp/index.html), a system that combines high definition video, audio, and call center technology with medical information, to create a virtual clinic experience.[13]

The most extensive randomized trial on TM versus conventional disease management was carried out with 1,665 elderly patients with

Table 8. Social Activity Limitation (Start Versus Final)

LIMITATION SOCIAL ACTIVITY START	F2F (FINAL LIMITATION SOCIAL ACTIVITY)				TM (FINAL LIMITATION SOCIAL ACTIVITY)			
	ALWAYS	SOME TIMES	NEVER	TOTAL	ALWAYS	SOME TIMES	NEVER	TOTAL
Always	13	13	26	52	15	10	20	45
Sometimes	7	13	35	55	13	21	73	107
Never	15	22	205	242	10	12	130	152
Total	35	48	266	349	38	43	223	304
	Chi-square 36.2; $p = 0.0001$				Chi-square 37; $p = 0.0001$			

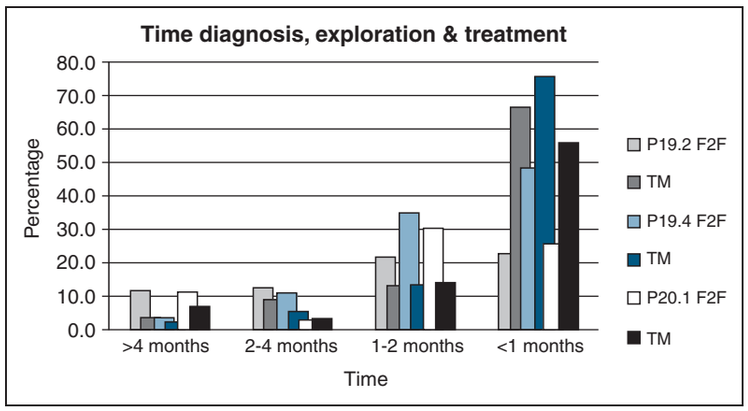

Fig. 7. Time to be examined, to be diagnosed, and waiting time for treatment.

diabetes in medically underserved areas of New York State, with excellent results.[14]

Generally speaking, the benefits of TM cannot be reduced to monetary measurements and other factors must be considered in aging populations situated far from urban areas. For these citizens, the quality of everyday life includes items not usually considered by health decision makers. Further, the benefits accruing from the use of TM are not evident in classical QoL questionnaires focusing on health items.

In our study, the TM-treated patients started with better health and less pain, probably because patients and physicians biased referrals by selecting the more severe cases for F2F consultation, for totally understandable reasons. The result was equal final health status and pain in both groups. Thus, the study showed that final health status and pain do not depend on the mode of medical care delivery, and the TM group showed similar results to F2F-treated patients.

The technology used was simple and could be updated to Web 2.0, the so-called Health 2.0. This facilitated hospital-patient-physician cooperation, building virtual health at home (VHealth @ home) in a noncontrolled manner or using the telepresence with/without robotics (www.intouchhealth.com/ITH_Stroke_320.html, accessed August 30, 2009). In addition, it could incorporate new-generation mobile phones playing a major role in content production through social networks, wikis, blogs, and the like. It is self-evident that the quality of services or contents cannot be ensured unless audited by bodies capable of issuing quality labels.[15] The result is an "empowering" of patients and healthcare services, which is a desirable result in places lacking healthcare facilities or in human disaster areas.

By contrast, the forthcoming Health 3.0 will offer high-quality healthcare using any Health Information Technology. It will provide integration, accessibility, and quality of care delivery to ensure health safety by reducing risk. This is the goal of the European Union, which has issued best practice guidelines for computer systems in healthcare (Good Automated Manufacturing Practice) and validation of computer systems and information technologies for healthcare and pharmacy (www.it-validation.eu, accessed August 30, 2009).

Table 9. Time Required for Physical Examination, Diagnosis, and Treatment

	DIAGNOSIS		PHYSICAL EXAMINATION		TREATMENT	
TIME	F2F	TM	F2F	TM	F2F	TM
>4 months	42 (17%)	10 (3.5%)	14 (4%)	6 (2%)	41 (16%)	21 (8%)
2–4 months	45 (18%)	27 (9.6%)	39 (11%)	17 (6%)	9 (4%)	11 (5%)
1–2 months	78 (32%)	41 (14.5%)	124 (36%)	41 (14%)	109 (44%)	45 (18%)
<1 month	81 (33%)	204 (72%)	169 (49%)	233 (79%)	90 (36%)	172 (69%)
Total	246	282	346	297	249	249
	Chi-square = 86.7; $p = 0.0001$		Chi-square 60.4; $p = 0.0001$		Chi-square 59.9; $p = 0.0001$	

Responses "not applicable" excluded.

Conclusion

The present randomized study of 800 patients referred to a hospital specialist either by TM or by usual F2F referral showed comparable health outcomes but better QoL by limiting traveling and expediting diagnosis, examinations, and treatment in the TM group of patients.

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