

Use of Medical Technologies in Rehabilitation Medicine Settings in Israel: Results of the TECHNO-R 2005 Survey

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Abstract

Background: With the development of computer technology and the high-tech electronic industry over the past 30 years, the technological age is flourishing. New technologies are continually being introduced, and questions regarding the economic viability of these technologies need to be addressed.

Objectives: To identify the medical technologies currently in use in different rehabilitation medicine settings in Israel

Methods: The TECHNO-R 2005 survey was conducted in two phases. Beginning in 2004, the first survey used a questionnaire with open questions relating to the different technologies in clinical use, including questions on their purpose, who operates the device (technician, physiotherapist, occupational therapist, physician, etc.), and a description of the treated patients. This questionnaire was sent to 31 rehabilitation medicine facilities in Israel. Due to difficulties in comprehension of the term "technology," a second revised standardized questionnaire with closed-ended questions specifying diverse technologies was introduced in 2005. The responder had to mark from a list of 15 different medical technologies which were in use in his or her facility, as well as their purpose, who operates the device, and a description of the treated patients.

Results: Transcutaneous electrical nerve stimulation, the TILT bed, continuous passive movement, and therapeutic ultrasound were the most widely used technologies in rehabilitation medicine facilities. Monitoring of the sitting position in the wheelchair, at the bottom of the list, was found to be the least used technology (with 15.4% occurrence). Most of the technologies are used primarily for treatment purposes and to a lesser degree for diagnosis and research.

Conclusions: Our study poses a fundamental semantic and conceptual question regarding what kind of technologies are or should be part of the standard equipment of any accredited rehabilitation medicine facility for assessment, treatment and/or research. For this purpose, additional data are needed.

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questions should be asked about which technologies increase costs and by how much. At issue is whether we can implement technologies that decrease the overall cost and increase the quality of care, rather than increasing costs without improving outcomes. To respond to these questions we need to define the basic, minimal technologies used in different rehabilitation medicine facilities. To date, health care providers and physicians lack precise information on how to optimally decrease disability and improve their patients' quality of life. If adequate means are not available for evaluating outcomes, diagnostic and therapeutic techniques/technologies may be used with little outcome benefit and, in some cases, at high cost.

The purpose of this survey was to identify the medical technologies currently in use in different rehabilitation medicine facilities in Israel. The goal of rehabilitation medicine therapy following an injury or disease is to facilitate recovery, i.e., to restore maximal functional activity. The course of recovery is determined by biological, psychosocial and environmental factors. Recovery involves biological processes of reorganization of both intact and damaged organs. These processes might take place in the peripheral, autonomous and central nervous system (including sensory, motor and endocrine modalities) [2]. It is therefore to be expected that assessment technologies may contribute to the monitoring of the "restogenesis" process [3] as well as to the patient's recovery. The present study focused on the more established methods (some of them old low level technologies such as the treadmill, the TILT bed, and biofeedback, or relatively new technologies such as virtual reality and computer-based cognitive treatments) with regard to their distribution and use in the country rather than investigating the implications of the more sophisticated modalities.

Materials and Methods

The TECHNO-R 2005 survey was developed by the Technology and Medical Procedures Committee of the National Rehabilitation Council in Israel and was conducted in two phases.

First phase, 2004

The survey used a questionnaire with open questions relating to the sort of technologies in use, their purpose, who operates the

Managed care relies on the use of medical technology in the field of diagnosis, treatment and research. The technological age has surged over the past 30 years thanks to the development of computer technology and the high-tech electronic industry. The field of biomedical engineering has helped fuel the fire for research and development in technology. However, it has been claimed that technological change has increased costs [1]. There has been an emphasis on introducing new technologies, but

device, and a description of the treated patients. This questionnaire was sent to 31 rehabilitation medicine facilities in Israel in 2004. These facilities included rehabilitation medicine departments, rehabilitation medicine day care units, and rehabilitation medicine outpatient follow-up clinics located in rehabilitation medicine centers, general hospitals or geriatric hospitals. During the statistical analysis we found that the term "technology" was understood in different ways, such that it was impossible to draw any meaningful conclusions.

Second phase, 2005

In 2005 the survey was revised to avoid the drawbacks of the first survey. This time we introduced a standardized questionnaire with closed-ended questions specifying diverse technologies. The responder had to mark from a list of 15 different medical technologies which are in use in his or her facility, as well as their purpose, who operates them, and a description of the treated patients.

Results

The findings are based on the data that were collected between June and October 2005. Two-thirds of the questionnaires were sent by mail and one-third was personally delivered to the rehabilitation facilities. The majority of questionnaires were completed either by the heads of the department or units or by the senior physicians.

Response rates

Of the 31 rehabilitation medicine facilities addressed, 26 (83.8%) responded to the survey. The miscellaneous facilities were classified into four groups: general rehabilitation medicine, geriatric rehabilitation medicine, pediatric rehabilitation medicine, and community rehabilitation medicine (which includes day care units and outpatient follow-up clinics). Pediatric rehabilitation medicine day care units were assigned to the pediatric rehabilitation medicine group.

Table 1 shows the response rate in each group. Of the 14 facilities in general rehabilitation medicine approached, 12 (85.7%) responded to the survey, signifying a high response rate. The highest response rate was encountered in the community rehabilitation medicine group, and the lowest (50%) in the pediatric rehabilitation medicine group.

Comparisons of medical technologies

After reviewing the first survey results collected in 2004 and the medical literature, we chose a subset of 15 devices and

Table 1. Response rate by rehabilitation medicine facilities

Rehabilitation medicine facilities	Facilities (N)	Response (N)	Response rate (%)
General	14	12	85.7
Geriatric	6	5	83.3
Community	7	7	100.0
Pediatric	4	2	50.0
Total	31	26	83.8

Table 2. Usage of medical technologies in different rehabilitation medicine settings (in %)

	Total	General rehab med	Geriatric rehab med	Community rehab med	Pediatric rehab med
TENS	96.2	91.7	100.0	100.0	100.0
TILT bed	92.3	100.0	100.0	71.4	100.0
CPM	92.3	100.0	80.0	85.7	100.0
Therapeutic ultrasound	92.3	91.7	80.0	100.0	100.0
Treadmill	88.5	83.3	100.0	85.7	100.0
Personal computer (PC) for cognitive exercise	76.9	66.7	60.0	100.0	100.0
Ergonomics	73.1	83.8	40.0	71.4	100.0
Biofeedback	73.1	66.7	60.0	85.7	100.0
Ultrasound for residual urine assessment	53.8	66.7	40.0	42.9	50.0
Nerve and muscle block	53.8	75.0	–	57.1	50.0
Alternative communication	50.0	58.3	–	71.4	50.0
Coordination eye-hand, biometrics	46.2	50.0	40.0	28.6	100.0
Pain management	46.2	66.7	40.0	28.6	–
Virtual reality	42.3	50.0	40.0	28.6	50.0
Monitoring of sitting position	15.4	8.3	20.0	14.3	50.0

TENS = transcutaneous electrical nerve stimulation, CPM = continuous passive movement

procedures representing the wide spectrum of technologies for acute and chronic conditions and preventive care processes in rehabilitation medicine. This subset was introduced in the questionnaire of 2005.

Table 2 shows the responses of each group of rehabilitation medicine settings with regard to the usage of each one of these 15 technologies as listed above. Transcutaneous electrical nerve stimulation, the TILT bed, continuous passive movement, and therapeutic ultrasound constitute the most widely used technologies in rehabilitation medicine settings. Monitoring of the sitting position in the wheelchair was found to be the least used technology (with 15.4% occurrence) and was placed at the bottom of the list.

Associations with used medical technologies

All respondents were asked to describe the purpose of each technology. The function of the indicated technology was classified into three categories (diagnosis, treatment, research). Table 3 provides data for each category for some selected medical technologies. Most of the technologies are used primarily for treatment.

Characteristics of the technology operators

Table 4 summarizes the characteristics of the operators of selected medical technologies according to their rehabilitation medicine profession. Physiotherapists operated 72% of the TENS devices and 79.1% of the TILT beds, constituting the most frequent usage of medical technologies in the rehabilitation medicine profession.

TENS = transcutaneous electrical nerve stimulation

Table 3. Selected medical technologies by its function (in %)

Function	CPM	Biofeed-back	Nerve and muscle block	Monitoring of sitting position	Ultrasound for residual urine assessment
Diagnosis	–	–	–	25.0	50.0
Treatment	91.6	47.4	78.6	25.0	14.3
Diagnosis & treatment	4.2	26.3	7.1	–	35.7
Research	–	–	–	–	–
Treatment & research	4.2	–	–	–	–
Diagnosis, treatment & research	–	26.3	14.3	50.0	–
Total	100.0	100.0	100.0	100.0	100.0

CPM = continuous passive movement

Discussion

The development and use of new technologies or new applications of existing ones have legal and ethical implications that arise subsequent to their use. Often, these legal and ethical implications are not new but gain prominence because their context may be new or has changed. Living in the post-modern 21st century we are exposed to unlimited information on new developments. In order to best utilize technological tools we need to filter this information to find the most practical, simple and applicable means. This is why in this survey we focused more on the established than on the newer sophisticated technologies.

Thirty years ago the question of the economic implications of new technical aids were examined in a study by Moogk-Soulis et al. [4], who questioned whether the addition of technical aids to the existing role of occupational therapists was economically justified. Dekker and co-authors [5] stressed that patients' compliance in using different technical aids should be examined with regard to patients' disability, disease, age and gender. They concluded that in order to ensure that technical aids meet personal needs, assessment of these characteristics is necessary.

The degree to which rehabilitation medicine care in Israel is consistent with basic quality standards is largely unknown. Even basic knowledge on the extent of utilization of special technologies in diverse rehabilitation medicine settings is unknown and not regulated at the present time. As a result, we have no comprehensive view of the level of quality of care given to the average patient in a rehabilitation medicine facility. This lack of information underscores that more should be done with regard to quality of care. As methods for measuring the quality of medical care have matured, the extent of these problems of quality has become increasingly evident. The solution, however, is much less obvious, particularly in view of the wide diversity of delivery systems. Many researchers have suggested that improved technology, systematic performance monitoring, and coordination of care are necessary to enhance the quality of rehabilitation medicine care. For instance, in the United States there are no mandatory regulations regarding rehabilitation medicine programs and collecting outcome data for skilled nursing facilities. As a result, it is not possible to conduct comprehensive ongoing cost-effectiveness comparisons between post-acute rehabilitation medicine facilities [6]. Our study opens a semantic and conceptual discussion

Table 4. Operation of selected medical technologies by type of rehabilitation medicine team members (in %)

Operator	TENS	Ergonomics	PC for cognitive exercise	Alternative communication	TILT bed
Physiotherapist	72.0	–	–	–	79.1
Occupational therapist	–	52.6	65.0	15.4	–
Speech therapist	–	–	–	61.5	–
Nurse	–	–	–	–	4.2
Physiotherapist & occupational therapist	24.0	42.1	10.0	–	12.5
Physician & physiotherapist	4.0	–	–	–	–
Physiotherapist, occupational therapist & nurse	–	–	–	–	4.2
Physiotherapist, occupational therapist & physician	–	5.3	–	–	–
Occupational therapist, speech therapist & nurse	–	–	–	7.7	–
Occupational therapist & speech therapist	–	–	20.0	15.4	–
Physiotherapist, occupational therapist, speech therapist & physician	–	–	5.0	–	–
Total	100.0	100.0	100.0	100.0	100.0

regarding what kind of technologies are or should be part of the standard equipment of any accredited rehabilitation medicine facility for assessments, treatments and/or research [7-9]. According to the responses obtained from an informal electronic inquiry of leading rehabilitation medicine facilities in the USA, Canada, Britain, Denmark, Italy, Japan and Hong Kong, currently there are no statutory technological requirements for the accreditation of a rehabilitation medicine facility.

Based on the results of the TECHNO-R 2005 survey, continuous passive movement, the TILT bed and TENS were reported as being the most frequently used technologies in rehabilitation medicine. These findings persisted when we adjusted for inpatient rehabilitation medicine in geriatric, general rehabilitation medicine, pediatric, and community rehabilitation medicine settings. The primary purpose of medical technology was reported as being targeted towards treatment and to a lesser extent to diagnosis and research. To our surprise, "Low Technologies" like biometrics were fairly underused. According to our findings, monitoring of the sitting position of wheelchair users, which is very important throughout rehabilitation medicine, was the least used technology.

Although our study is one of the most comprehensive comparisons of the utilization of medical technologies in several national rehabilitation medicine facilities, we faced some difficulties such as the lack of an accepted definition and the meaning of the concept of "technology in rehabilitation medicine."

No-response bias is a potential limitation of the study.

Because the sample we analyzed included two pediatric departments with 50% no-response, the results are likely to be biased, and the direction of that bias is not clear.

The implications of these data are important for our understanding of quality management in rehabilitation medicine and prompted several questions. First, which medical technologies [10-16] should be defined as essential in a rehabilitation medicine facility? Second, should the rehabilitation medicine facility demand that a rehabilitation medicine technology be inside the facility or is the availability of this technology nearby, e.g., the general hospital, sufficient? Third, should the entire rehabilitation medicine team be involved and encouraged in mutual learning and instruction with regard to operating these technologies? Fourth, how should a new technology be implemented: should it be introduced first in a rehabilitation medicine center and then gradually in other peripheral settings, or should it be implemented simultaneously? Subsequent to previous discussions, should it be mandatory for the rehabilitation medicine care delivery system to establish clear policies on accreditation of medical technology operators in order to enable proper handling of this technology?

The findings of our study may contribute to improving care by providing important data and drawing attention to existing technologies in use [17,18]. More research is needed to address the above questions in order to optimize the effectiveness of quality management systems in rehabilitation medicine.

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