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Original Article

Medical teleconsultation to general practitioners reduces the medical error vulnerability of internal medicine patients

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ABSTRACT

Background: e-Health strategies are supposed to improve the performance of national health systems. Medical teleconsultation (MT) is an important component of such e-Health strategies.
Objectives: The outcome of MT was evaluated with regard to the impact on the medical error vulnerability (MEV) of internal medicine patients.
Methods: A team of internal medicine doctors plus a network of forty specialists was set-up in one health district belonging to a unified and universal national health system of a country of Western Europe, in order to provide free-of-charge MT to support general practitioners in solving internal medicine cases. In this observational study, the case series of 2013 is reviewed.
Results: a) Only 21% of the MT fell short to the general practitioner's expectations about the case solving focus; b) throughout the medical care process of the patient, 49% of the cases met with one or more of the five MEVs, namely: 1) clinical test mishandling; 2) inaccurate differential diagnosis; 3) inadequate information flow between health providers at different levels of care (transition care); 4) poor coordination between health providers; and 5) poor reconciliation of medications or hazardous therapies. c) MT canceled or prevented MEVs in 56% and mitigate MEVs in 15% of the cases; d) MT canceled or prevented 85% of MEV caused by poor information exchange in transition care, therefore improving patient referral and counter-referral.
Conclusions: MT reduces MEV and therefore, whenever implemented to a large extent, may improve the quality of health care delivery and the performance of national health systems.

1. Introduction

In the World Health Report 2000, the World Health Organization (WHO) made an effort to rank the performance of the national health systems worldwide. [1]. WHO's ranking system is based on three groups of indicators: 1) population's health status, estimated through life expectancy, mother mortality rate, mortality rate for children under five, etc.; 2) responsiveness to the fair and realistic expectations of the population, therefore capacity of delivering an effective medical care to individuals; and 3) countries' financial commitment in health and sustainability [2,3].

More recently, in 2013, Bloomberg issued a ranking system pretty similar to WHO's, by basing on slightly different indicators, [4].

All the highly placed health systems of Western Europe have the strong advantage of their being unified (one management structure for both private and public services) and universal (providing health care and financial protection to all citizens) [5]. Actually, such a health system model enables prevention policies and strategies to be smoothly implemented countrywide, the largest health coverage and patient centeredness to be attained and a good share of the gross domestic product to be allocated for health.

With regard to the health care delivery to individuals, the unified and universal health systems are arranged in three major levels of complexity: 1) the primary health care, delivered by general practitioners

Abbreviations: GP, General practitioner; ICT, Information and communication technologies; MEV, Medical error vulnerability; MT, Medical teleconsultation; WHO, World Health Organization; ITU, International Technology Unit.

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(family doctors); 2) the secondary health care (intensive and/or specialist medical care in ambulatory outreaches, health centers and district hospitals); and 3) the tertiary health care, delivered by university hospitals of high specialization [6].

Whenever the health problem of the patient cannot be managed and solved at primary health care level, the patient is processed through levels of higher complexity in a sequence of referral and counter-referral events (transition care). Although this pattern of medical care enables almost any health problem to be solved, it is commonly observed that transition care may be causing vulnerability for medical error, discontinuity of care and even conflicts between medical care providers. Sometimes, in transition care, specialists' over requesting of diagnostic tests and drug prescriptions occur with no global knowledge or understanding of the clinical history of the patient [7]. Such medical error vulnerability (MEV) and conflicts are often perceived by the patient as a poor performance of the whole health system, undermine the patient's trust and satisfaction and therefore badly affects the above-mentioned indicator no. 2 of WHO.

Nowadays, the WHO and the International Technology Unit (ITU) are encouraging countries to make use of information and communication technologies (ICT) increasingly. Indeed, ICT are supposed to improve the performance of the national health systems (e-Health strategies) [8,9]. Of the several ICT tools of e-Health, one is medical teleconsultation (MT).

In 2010, we set-up the De Martinis Telemedicine Panel (Dematepa), which is made up of a network of internal medicine doctors and specialists of various medical disciplines. Dematepa is an MT system providing free-of-charge counseling, second opinion and support to applying GPs in internal medicine case solving.

By reviewing the case series of Dematepa, the purposes of this observational study are to evaluate: 1) the effectiveness of MT in responding to the requests of GPs; 2) the occurrence of MEVs; and 3) the capacity of MT in controlling MEVs.

2. Materials and methods

The core team of Dematepa is made up of eight professionals, namely: a) four internal medicine specialists jointly covering all the levels of medical care complexity (two practicing physicians, experienced in primary health care, one experienced in district hospital care and one with a background and understanding of highly specialist care); b) one pediatrician; c) one radiologist; d) one pathologist; and e) one computing and telecommunication engineer. An additional network, made up of forty specialists of different medical disciplines, supports Dematepa upon request (internal specialists). Dematepa gives the opportunity to authenticated GPs to apply for being counseled about the diagnosis, therapy, and follow-up of their patients. The application reserves the privacy of the patient to the fullest extent [10]. In fact, Dematepa members are kept unaware of the patient's identity throughout the whole process [11].

The applying GP has to make clear the focus of his request of MT (f.i. doubts regarding the specialist-issued clinical report, interpretations of the X-ray or laboratory tests, identification of qualified consultants, quick access to further clinical tests, recommendations regarding treatments, etc.) and the expected results from his application. Since it is well known that MT can be successful to varying extents according to various pathologies [12], Dematepa accepts the application only if its members believe that such an MT is likely to result in some benefit and provide the expected results with regard to the focus.

As in literature one can read plenty of papers about big series of on-line issued reports of clinical tests like X-rays, magnetic resonance imaging, ECG etc., even in extreme and remote areas and under emergency conditions [13], we focused on MT to solving problems of chronically ill patients, whose clinical processing may involve all the levels of care complexity. Indeed, chronic diseases are making up the heaviest workload of the health systems of Western Europe countries. Thus, improving the health care management of such patients at large extent is supposed to affect the overall performance of the health system.

Upon approval of the GP's application, clinical reports/documents/data about the patient are collected, converted into digital format, filed anonymously and shared by emailing within the Dematepa member network. Within 5 days' time and in accordance with the established focus, Dematepa members are called to an MT virtual meeting (teleconference) with the applying GP, the relevant internal specialists and, whenever necessary, with the patient.

For teleconferencing, Dematepa makes use of open-source applications. They are chosen as the user-friendliest ones, to enable also external participants, who may not be familiar with sophisticated applications, to log in. These applications are multitasking and include slide presentation, video streaming, chat room, webcam, and multichannel audio.

During the MT teleconference, the GP presents the anamnesis, the clinical signs and the relevant documentation of the medical case, while keeping concealed the identity of the patient. According to the good practices of the clinical method, a differential diagnoses diagram is drawn-up immediately, whenever not yet done at an earlier stage [14,15]. The rank of differential diagnoses is in accordance with the a-priori probability of the Bayes theorem [16]. Simultaneously, any differential diagnosis is matched with the appropriate actions to solve.

By basing on such a diagram and in agreement with the GP, Dematepa members make a plan of patient processing actions. It may include: a) broadening the knowledge by reviewing scientific literature; b) integrating the physical examination of the patient by teleconferencing along with the GP; c) driving and helping the GP in booking other clinical tests with various services (radiology, biochemical laboratory, cytology etc.); and d) proposing more qualified specialists (internal or external to Dematepa) to consult. In the following days, the plan of action is implemented and the patient undergoes the planned clinical tests.

As soon as the patient processing is over, a final debriefing is held asynchronously (by e-mail exchange) or synchronously (by teleconferencing within all the involved health professionals). Recommendations are issued to the GP and/or the patient.

The GP follows-up the patient and feeds back Dematepa members. After a convenient period of time of follow-up, the clinical case is filed in a database. By holding a teleconference more, the following parameters are monitored and evaluated, according to a Boolean variables choice (on/off, positive-negative):

1) Full or incomplete achievement of the expected results with regard to the focus. In case of failure, causes are investigated according to three groups: a) Technical; b) Human (GP, patient, specialist); and c) Methodological.
2) By going through the entire history of patient processing [17], the occurrence of one or more of the five medical error vulnerabilities (MEVs), namely:
   a) Execution of unnecessary clinical tests (laboratory, X-rays etc.) and/or their duplication and/or wrong interpretation (*clinical test mishandling*);
   b) Missing or inaccurately-drawn differential diagnoses diagram by the GP or by other health care providers (*inaccurate differential diagnosis*);
   c) Inadequate information flow among the different health care levels in care transition (*inadequate information flow*);
   d) Lack of a final decision-making coordination meeting among health care providers (*poor coordination*);
   e) Incorrect recommendation to the patient to undergo ineffective or hazardous treatments and/or occurrence of adverse drug reactions poorly monitored and challenged by the health care providers (poor reconciliation of medications — *hazardous therapy*).

Such taxonomy of medical errors was taken from Dovey and co-workers, while focusing only on the medical care errors in family practice