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Telemonitoring of patients with advanced non-curable diseases: A narrative review and initial experience in the home visit program of the National Center for Pain Control and Palliative Care during the national emergency related to COVID-19

Telemonitoreo de pacientes con enfermedades avanzadas no curables: Revisión narrativa y experiencia inicial en el programa de visita domiciliar del Centro Nacional de Control del Dolor y Cuidados Paliativos durante la emergencia nacional relacionada con COVID-19

Gabriel Carvajal-Valdy[1,a,*], Marco Ferrandino-Carballo[1,a], Sandra Maykall-Mora[1,a], Catalina Saint-Hilaire Arce[1,a]

Abstract

Telemedicine describes the electronic delivery of medical data for diagnosis, treatment, and medical education to the patient at home through the use of information and communication technologies. In just a few weeks, the current global situation related to COVID-19 has placed unprecedented pressures on the healthcare system and transformed the practice of palliative care. The home visit program of the National Center for Pain Control and Palliative Care adopted the teleconsultation modality in March 2020 and a pilot plan for the evaluation of telemonitoring technology was established. During the initial evaluation period between March and July 2020, a doctor specializing in Palliative Medicine reviewed vital signs within 24 hours after transmission and carried out a teleconsultation to the patient, allowing the data received to be analyzed. In total 14 patients were monitored for an average of 10.2 ± 3.7 days for a total of 143 days of multiparametric monitoring and 3432 hours of monitoring. Preliminary results from this study suggest a positive effect on symptom control, patient satisfaction, staff education, and communication between team members.

Keyword: telemedicine, remote consultation, patient monitoring, COVID-19, palliative medicine

Resumen

La telemedicina describe la entrega electrónica de datos médicos para diagnóstico, tratamiento y educación médica al paciente en el hogar mediante el uso de tecnologías de información y comunicación. En pocas semanas, la situación mundial actual relacionada con COVID-19 ha generado presiones sin precedentes en el sistema de salud y ha transformado la práctica de cuidados paliativos. El programa de visita domiciliar del Centro Nacional de Control del Dolor y Cuidados Paliativos adoptó la modalidad de teleconsulta en marzo 2020 y se estableció un plan piloto de evaluación de la tecnología de telemonitoreo. Durante el periodo inicial de evaluación comprendido entre marzo y julio 2020, un médico especialista en Medicina Paliativa revisó los signos vitales dentro de las 24 horas posteriores a la transmisión y realizó una teleconsulta al paciente permitiendo analizar los datos recibidos. En total 14 pacientes fueron monitorizados durante un promedio de 10.2 ± 3.7 días para un total de 143 días de monitoreo multiparamétrico y 3432 horas monitoreo. Los resultados preliminares de este estudio sugieren un efecto positivo en el control de síntomas, la satisfacción del paciente, la educación del personal y la comunicación entre los miembros del equipo.

Palabras clave: telemedicina, consulta remota, monitoreo de pacientes, COVID-19, medicina paliativa

[1]Centro Nacional de Dolor y Cuidados Paliativos, San José, Costa Rica.

[a]Specialist in Medicina Paliativa

ORCID:
[*]https://orcid.org/0000-0001-9552-0815

Corresponding author:
Dr. Gabriel Carvajal

Postal Address: Centro Nacional de Dolor y Cuidados Paliativos, San José, Costa Rica

Email: ggcarvaj@ccss.sa.cr

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Introduction

The World Health Organization has defined Telehealth (including telemedicine) as the delivery of health services using information and communication technologies, specifically when distance is an obstacle to health services, this allows providing medical care outside of traditional healthcare facilities (1). These telehealth technologies have been used in different disease states with the goal of reducing morbidity, mortality, and cost of care, while employing an innovative design. Palliative care has previously shown promising results using video calls in pilot studies. In just a few weeks, the current global situation related to COVID-19 has placed unprecedented pressures on the healthcare system and transformed the practice of palliative care.

This exceptional global situation has generated the need for adaptations in order to give continuity to health services avoiding risk exposures for patients, their families and health personnel (2). For health centers, strict limitations on visitors have meant that some palliative care programs are practicing virtually and it is increasingly necessary to preserve limited resources such as personal protective equipment, generating the current challenge of finding an effective way to offer effective health care to this fragile population while minimizing the burden about health care resources. Telemedicine has become an alternative to meet this objective: The use of technological platforms can play a role in the follow-up of highly complex cases and although its adoption by doctors who treat patients with advanced diseases has not been wide, there is potentially an opportunity to help critically ill patients through these innovative resources (3).

Methods

A search was carried out on the existing literature in the PubMed, SCIELO, CINAHL and Cochrane Library databases using the following MESH index entries: Palliative care, telehealth, telemonitoring, COVID19 and their combination. The search was completed in June 2020. Thirty updated articles congruent with the interests of the research were selected. Posteriorly, the preliminary results of the introduction were analyzed through a pilot plan of this telemonitoring technique in the National Center for Pain Control and Palliative Care, a specialized center of the Costa Rican Social Security Fund.

Limitations in the medical care of populations with advanced non-curable disease, during the national emergency due to COVID-19

Providing specialized follow-up in palliative care to frail and dependent patients with multiple chronic conditions is a significant challenge for healthcare systems due to the large burden of care required. Home visit programs are an evidence-based tool to improve coordination and access to care for frail and dependent patients and reduce unnecessary hospitalizations as well as ensure end-of-life at home.(4) The National Center for Pain Control and Palliative Care has a home visiting system that actively cares for nearly 600 patients with advanced non-curable diseases. This specialized care requires face-to-face travel by a multidisciplinary health team, and implies in this exceptional historical context interactions that could be associated with the transmission of the SARS-CoV-2 virus in particular in a subpopulation that, given the sum of commonly present risk factors such as frailty, advanced age, kidney disease, high blood pressure, ischemic heart disease or cancer is likely to have an unfavorable outcome to the development of a SARS-CoV-2 infection(5). In the same way, these interactions can facilitate accidental infections since even respecting measures of strict prevention such as the use of personal protective equipment, close contact with patients with COVID-19 can cause the transmission of the disease to patients and staff.(6) In addition to this, it is relevant to recognize that internationally the limited access to personal protective medical equipment has been a recurrent problem.(7)

An alternative to face-to-face home consultation: the telemedicine

The Telemedicine describes the electronic delivery of medical data for diagnosis, treatment and medical education to the patient at home through the use of information and communication technologies.(1) The primary objective of telemedicine is the improvement of patient care combined with an increase in the efficiency of the medical services and in particular in the context of the current national emergency - the reduction in face-to-face contacts with the health services. To administratively support these changes, some local regulatory measures have been adopted: the College of Physicians and Surgeons of Costa Rica has issued guidelines in the 2020-04-01 Ordinary session, agreeing to approve the “General Guidelines for the Provision and Control of the Exercise of Medicine and Surgery, its Specialties and Subspecialties - Special Modality During the National Emergency due to COVID-19”, regulating the introduction of telemedicine and facilitating the rapid dissemination of this on a national level.(8)

Types of telehealth intervention

Telemedicine can be carried out synchronously, asynchronously, or in combination with in-person care. The patient and the physician can interact virtually via video technology in real time or asynchronously storing and forwarding clinical data, such as medical reports, forms, images and video recordings, to be interpreted at a later time.(9) There are studies that have demonstrated positive results in patients with progressive chronic diseases such as heart failure(10,11) Chronic Obstructive Pulmonary Disease(12), chronic liver disease(13) as well as in cancer patients.(14,15) Recent anecdotal efforts are evaluating this technology for rural communities.(16)

Most of the described asynchronous interventions use a form of home telemonitoring (using a telephone or computer software to record clinical signs or symptoms from the patient's home). Patient and family participation are important elements to ensure regular recording, and there are specific applications that allow symptom recording using scales such as the Edmonton Symptom Inventory. Patient self-report and telemonitoring provide opportunities to identify escalating symptoms and facilitate timely proactive palliative care.

Synchronous consultations require an evaluation by phone call or video call, for this technologically accessible interventions such as the use of smart phones, tablets and videoconferencing applications may be possible but require that both the clinician and the patient have access to these tools.(17) This technology can facilitate multidisciplinary participation and cooperation among healthcare professionals and there are general recommendations for adaptation to telemedicine based on the experience of the University of San Francisco in California and the ResolutionCare network.(18,19)

In particular situations, clinicians may consider the need to assign monitoring devices to ensure physiological surveillance of cases with a higher burden of care. Examples of such patients are those with a high burden of physical symptoms (eg ascites, pleural effusion) and complex interventions such as supplemental oxygen, intravenous medication, epidural and intrathecal medication, and drug treatments that may require frequent titration and monitoring (eg potent opioids , benzodiazepines, ketamine). Telemonitoring can

allow a better allocation of human and therapeutic resources and could be a useful tool to improve the general well-being of patients followed in home visit programs. Different devices offer specific capabilities: there are modules that allow monitoring of physiological parameters such as oximetry, respiratory rate, pulse, electrocardiography, weight, and glucose. This information can be integrated into video calls in order to make remote therapeutic decisions.

Accumulated experience in a center specialized in pain treatment and palliative care

The home visit program of the National Center for Pain Control and Palliative Care adopted the teleconsultation modality in March 2020 and a pilot plan for the evaluation of telemonitoring technology was established using the FORA system (FORA Care®, USA). Telemonitoring equipment consisting of a pulse oximeter, a non-invasive blood pressure meter, a glucometer, a scale, and a digital thermometer were delivered to relatives of patients previously selected by program specialists. (Figure 1)

Figure 1. Photograph of the digital devices of the FORA® system delivered for telemonitoring of vital signs. A) Pulse oximeter, B) Glucometer, C) Thermometer, D) Sphygmomanometer, E) Scale.

The selected patients or their main caregiver received training in the correct positioning and basic use of the monitors and were given a contact telephone number in order to clarify any questions regarding the technology. The patients were followed up by periodic teleconsultation by a specialist in Palliative Medicine. The telemonitor data was delivered electronically over a wireless connection, using an internal modem in the telemonitor, which can transmit without a telephone line or home internet connection. The telemonitoring transmitted data to the FORA® software program and these were analyzed through the Internet from the coordination office of the home visit program of the National Center for Pain and Palliative Care. (Figure 2)

Preliminary results

During the initial evaluation period between March and July 2020, a doctor specializing in Palliative Medicine reviewed vital signs within 24 hours after transmission and carried out a teleconsultation to the patient, allowing the data received to be analyzed. In total 14 patients were monitored for an average of 10.2 ± 3.7 days for a total of 143 days of multiparametric monitoring and 3432 hours of monitoring. 1578 Parameters were analyzed and 50% of the patients were diabetic. (Table 1)

Table 1. Main results of the telemonitoring

Total patients	14
Women	9 (64%)
Men	5 (36%)
Average age	65±18
Average duration of monitoring (days ± SD)	10.2 ± 3.7 days
Total monitoring time	3432 hours

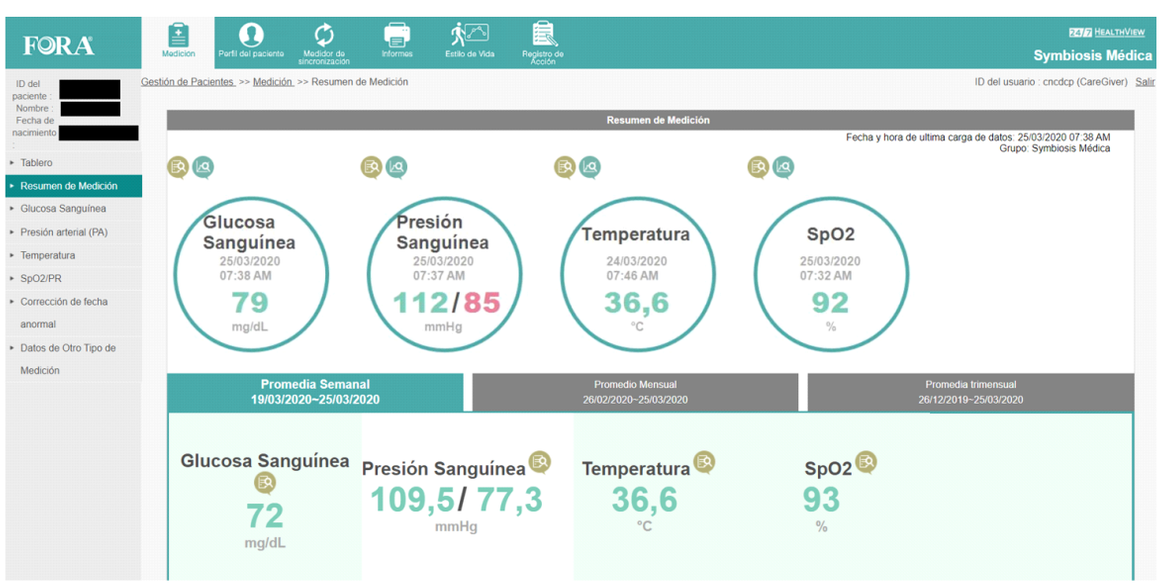

Figure 2. Physiological parameters evaluated through the telemonitoring devices of the FORA® system

Discusión

Home visit programs are an important element of the service offering for patients with advanced non-curable conditions: multiple studies have indicated that most patients wish to die at home, and a systematic review by Cochrane showed that home care at the end of life the probability of dying at home increased.(20,21)

Preliminary results from this study suggest a positive effect on symptom control, patient satisfaction, staff education, and communication between team members. Telemonitoring and teleconsultation using video calls have advantages over telephone calls, but limitations compared to in-person visits, suggesting that they are an alternative but not a replacement for face-to-face consultations.(22) (Table 2)

In a qualitative review that included 22 articles from 19 studies, the authors established that the use of telehealth in palliative care at home seems to be feasible, since it improves access to health professionals at home and increases the feeling, however, there are contradictory results on whether the use of telehealth improves quality of life.(23) It is important to recognize that physicians may have reservations regarding permanent telemonitoring of the patient by perceiving it as disproportionate in specific situations.(24) Home telemonitoring for cancer patients significantly increases pain recording and painkiller prescriptions in outpatient medical records.(25) Used to its full potential, telehealth technology could be particularly relevant for improving access to healthcare at a geographic distance and multi-parameter monitoring outside of normal working hours.(17)

Costa Rica has a robust network of high quality and integrated pain control and palliative care units recognized as one of the best in Latin America according to the quality of death index.(26–28) Even so, this system has limitations and there are disparities in care, particularly in rural settings, that can potentially be improved using innovative strategies.

Other ambulatory monitoring technologies

Recently, different technologies focused on the development of telemonitoring solutions have been introduced to the country, the National Center for Pain Control and Palliative Care considered FORA® technology in this pilot phase, however other platforms are available in Costa Rica such as Biobeat® and the TotalVitals® module from GlobalMed®. FORA® was chosen in the pilot phase considering that at the initial moment of the national emergency this was the only technology with immediate commercial viability in the country and that there were clinical trials that supported its safety and efficacy.

Biobeat® consists of a technology based on plethysmography, potentially requiring less collaboration from caregivers or the patient to take measurements of temperature, blood pressure, heart rate, oximetry. Two platforms have been designed in this system: A remote ambulatory monitoring system where by placing a patch on the patient's chest, it can be continuously monitored for up to 7 days and the second solution allows long-term monitoring by means of a wrist monitor. Other parameters that can be monitored are respiratory rate, systemic vascular resistance, cardiac output / cardiac index, and heart rate variability. It is important to note that Biobeat® requires a SIM card for internet access while FORA® makes an automatic connection to the best available 3G wireless network without using a SIM card (Subscriber Identity Module). This system is used mainly in the US and has been evaluated in clinical trials to optimize blood glucose levels in patients with diabetes mellitus(29) and to reduce hospital readmissions in patients with heart failure.

The Globalmed® platform consists of a modular alternative for which basic telemonitoring modules such as blood pressure, heart rate, pulse oximetry, temperature and complementary modules can be adapted for the evaluation of parameters such as glycemia, twelve-lead electrocardiography and spirometry.

Figura 3. Dispositivos de monitorización de Biobeat®. Monitor de pulsera y monitor de parche

Each health center will therefore need to know the technological offer available in order to adapt it to the specific needs of the population served. We anticipate that access to this type of technology will allow the outpatient monitoring of patients after surgical procedures, therapeutic procedures or the monitoring of patients with chronic chronic diseases, ensuring patient autonomy.

Despite current uses in palliative care, we believe that technology is underused and has great potential to improve the quality of palliative care and outcomes for patients and families. (30)

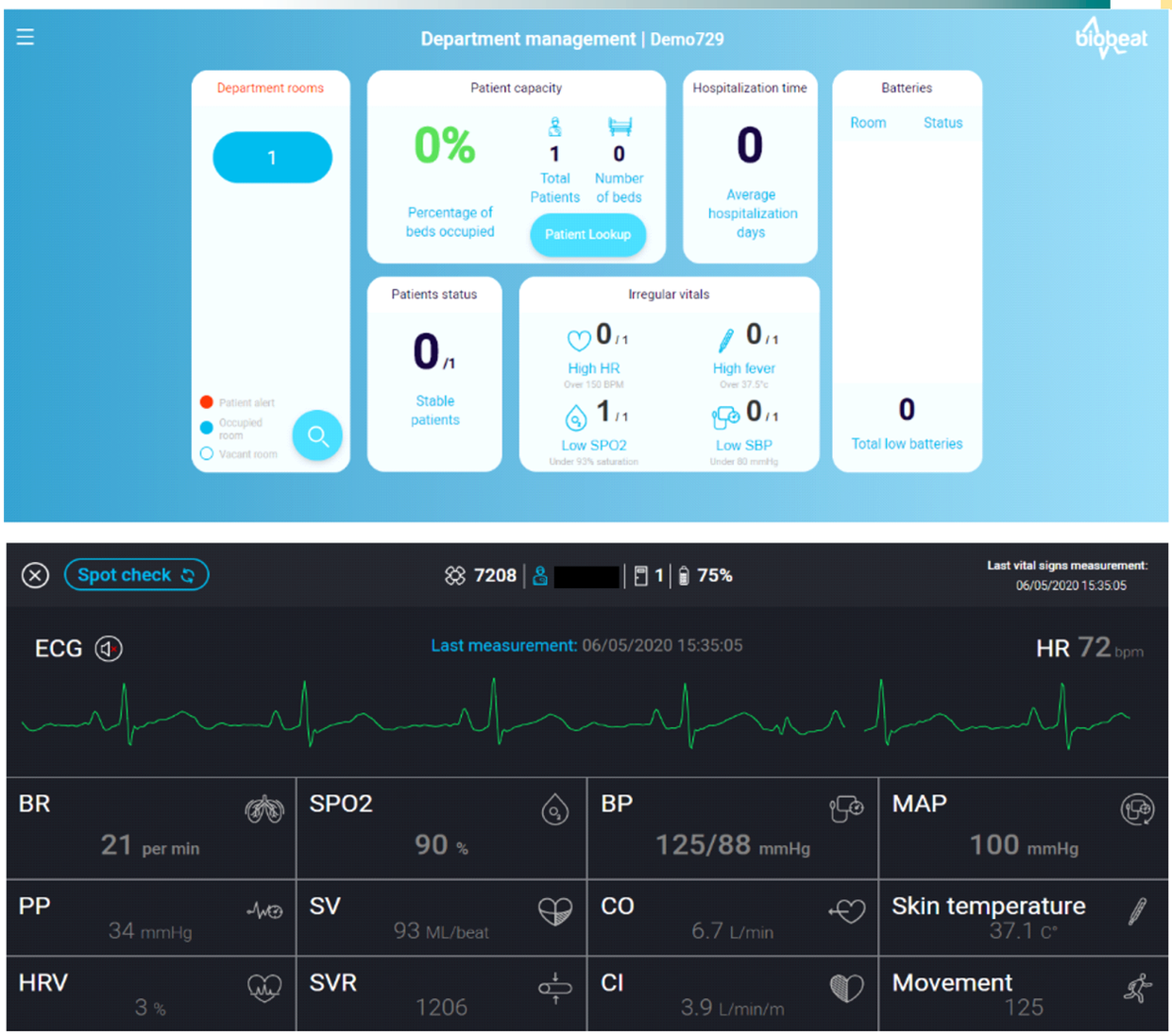

Figure 4. Image of the Biobeat® monitoring platform and monitoring parameters

Figure 5. GlobalMed® monitoring device

Table 2. Advantages and disadvantages detected in telemonitoring in the follow-up of patients included in the home visit program of the national center for pain control and palliative care.

Potential benefits	Potential disadvantages
Allows the allocation of human resources and therapeutic resources based on objective parameters	Requires collaboration from patients
It allows the monitoring of several cases simultaneously from a single center, limiting travel	Face-to-face communication is an essential component of end-of-life care
Allows the development of a centralized organizational plan	Potential source of anxiety in caregivers
Detection of potentially serious physiological abnormalities at a distance (eg hypoxemia, bradycardia, hypoglycemia, fever)	

Conclusiones

Now that the feasibility of telemonitoring in the home visit program of the National Center for Pain Control and Palliative Care has been confirmed in the context of the national emergency related to COVID-19, we consider that larger studies are needed to verify its positive impact on quality of life. Specific research is needed to understand the benefits, risks, barriers, and enablers to the adoption and larger-scale application of this technology. In particular, it is necessary to evaluate the use of telehealth in palliative care and improve the design of telehealth in line with digital service standards.(31) In the future, it should be analyzed to guarantee equitable access to telemonitoring technology for vulnerable urban and rural populations through the national network of Pain Control and Palliative Care Units of the Costa Rican Social Security Fund.

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Contribution of the authors

Dr. Carvajal participated in the conception, design, data acquisition, writing of the manuscript, analysis and interpretation of data. Dr. Ferrandino participated in the conception, design of the project, data acquisition and revision of the manuscript. Dr. Maykall participated in the conception of the research, the analysis of the data and the revision of the manuscript. Dr. Saint Hilaire participated in the conception of the research, the analysis of the data and the revision of the manuscript.

Interest conflict

We declare no conflict of interest

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