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ORIGINAL ARTICLE

Development of an evidence-based hybrid model in the primary care

Desarrollo de un modelo híbrido basado en evidencia en la atención primaria

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Abstract

Background: *The hybrid care model (HCM) is a means to facilitate education and healthcare delivery both in-person and telehealth. It aims to reduce unscheduled appointments, emergency room visits, and hospitalizations. There is limited information on the impact of HCM s in the country.* **Objective:** *The study aims to develop an evidence-based HCM to assess cardiometabolic control, decrease unscheduled appointments, emergency room visits, and hospitalizations during the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic in patients with non-communicable chronic diseases in the primary care.* **Material and methods:** *This paper presents the development of an evidence-based HCM as the frame of reference of a cohort observational registry study with a 48-month follow-up in the primary care clinics of Centro Médico ABC.* **Results:** *From April 01, 2021, to April 01, 2023, the registry recruited 1,412 outpatient clinic patients, aged 18 and above, both sexes, with non-communicable chronic diseases, such as overweight, obesity, pre-diabetes, diabetes type 1 and 2, and hypertension. The HCM consists of three elements: (1) Telehealth consultations, (2) in-person consultations, and (3) health education.* **Conclusions:** *This article provides the framework for future studies and analysis of the results of an evidence-based HCM in Mexican patients with non-communicable chronic diseases. The model's approach aims to evaluate cardiometabolic control, as well as to estimate the prevalence of acute events such as unscheduled appointments, emergency room visits, and hospitalizations during the SARS-CoV-2 pandemic.*

Keywords: *Chronic disease. Telehealth. Cardiometabolic risk factors. Emergencies. Hospitalizations.*

Resumen

Antecedentes: *El Modelo de Atención Híbrida (MAH) es un medio para facilitar la educación y la prestación de atención médica tanto en persona como a través de telesalud. Su objetivo es reducir las citas no programadas, las visitas a la sala de emergencias y las hospitalizaciones. Existe información limitada sobre el impacto de los modelos de atención híbrida en el país.* **Objetivo:** *El estudio tiene como objetivo desarrollar un MAH basado en evidencia para evaluar el control cardiometabólico, disminuir las citas no programadas, las visitas a la sala de emergencias y las hospitalizaciones durante la pandemia de SARS-CoV-2 en pacientes con enfermedades crónicas no transmisibles con atención primaria a la salud.* **Material y métodos:** *Este documento presenta el desarrollo de un MAH basado en evidencia como marco de referencia de un estudio de registro observacional de cohorte con un seguimiento de 48 meses en las clínicas de atención primaria del Centro Médico ABC.* **Resultados:** *Del 1 de abril de 2021 al 1 de abril de 2023, el registro reclutó a 1,412 pacientes*

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ambulatorios, de 18 años o más, de ambos sexos, con enfermedades crónicas no transmisibles como sobrepeso, obesidad, prediabetes, diabetes tipo 1 y 2 e hipertensión. El Modelo de Atención Híbrida consta de tres elementos: (1) consultas de telesalud, (2) consultas en persona y (3) educación para la salud. **Conclusiones:** *Este artículo proporciona el marco para futuros estudios y análisis de resultados de un MAH basado en evidencia en pacientes mexicanos con enfermedades crónicas no transmisibles. El enfoque del modelo tiene como objetivo evaluar el control cardiometabólico, así como estimar la prevalencia de eventos agudos como citas no programadas, visitas a la sala de emergencias y hospitalizaciones durante la pandemia de SARS-CoV-2.*

Palabras clave: *Enfermedad crónica. Consulta remota. Factores de riesgo cardiometabólicos. Emergencias. Hospitalización.*

Introduction

In Latin American countries, it is common to have community clinics at the primary care level. Community clinics during the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic provided primary health care to ensure proper follow-up for the comorbidities of the patients. Primary health care was delivered through a hybrid care model (HCM) consisting of in-person and telehealth services to meet the clinical needs of the patients. The HCM was relevant during the SARS-CoV-2 pandemic and will continue to be so in the future[1].

The HCM combines in-person and telehealth services to provide a flexible and comprehensive approach. In-person appointments are reserved for physical exams, complex diagnoses, and procedures that require being present. In-person consultations remain essential for physical evaluations and procedures that require physical presence. This optimizes time and resources while ensuring comprehensive and adequate care for each patient. Telehealth is used for situations that do not require physical presence, such as follow-ups, medical advice, and initial discussions[2,3]. Telehealth is a means to provide health services, utilizing communication technologies for information exchange in diagnosis, treatment, disease prevention, and health education[4]. Telehealth has become increasingly relevant for non-urgent or follow-up consultations.

Within the framework of the SARS-CoV-2 pandemic, a HCM was developed at the Brimex and Amistad Clinics of Centro Médico ABC (CMABC). CMABC is a non-profit organization with a tradition of service spanning over 35 years. The Brimex and Amistad Clinics serve over 4,000 socioeconomically vulnerable patients residing in the surrounding areas of the hospital. These clinics provide multidisciplinary care with support from laboratory studies, imaging services, and hospitalization facilities. During the pandemic and its lockdown measures, one of the clinics' concerns was the potential exacerbation of chronic conditions among patients, leading to increased unscheduled appointments, emergency room visits, and hospitalizations. To address this issue and prevent both patients and the institution from incurring higher costs, the implementation of a HCM was proposed.

Research studies involving patients with non-communicable chronic diseases have shown that a HCM provides more patients with access to healthcare and mitigates the risk of disparities in healthcare access[5]. Utilizing telehealth has been and continues to be an alternative to address differences in access. Active patient participation in HCM can help reduce the inequality gap[6].

This research work presents the development of an evidence-based HCM as the frame of reference of a prospective cohort observational registry study with a 48-month follow-up of patients with non-communicable chronic diseases at the Brimex and Amistad CMABC. This communication provides the framework for future publications to evaluate cardiometabolic control, unscheduled appointments, emergency room visits, and hospitalizations during the SARS-CoV-2 pandemic in patients receiving health services in an HCM.

Material and methods

The HCM was a 48-month prospective cohort observational registry study. The study was submitted to the Ethics and Research Committees of Centro Médico ABC with approval numbers ABC-10-27 and ABC-19-34. All patients received and signed informed consent forms in accordance with Mexican regulations[7]. The generated documentation was securely stored electronically and, in the institution's clinical archive following legal guidelines for personal data protection[8].

The HCM was carried out by the multidisciplinary team at the Brimex and Amistad Primary Care CMABC, comprising six general practitioners, four specialist physicians (internal medicine, geriatrics, cardiology, endocrinology), one psychologist, two nutritionists, three dentists, five nurses, one pharmacist, and

professionals from the following specialties: Social work, administrative, and information technology. In addition to the previously mentioned fields, undergraduate students in medical, psychology, nutrition, dentistry, and nursing programs also participate in social service activities.

Patient selection process

Patient enrollment included the entire affiliated population of the clinics. The universe was represented by 1,412 patients. Patient selection occurred consecutively from April 01, 2021, to April 01, 2023. Eligible patients were aged 18 and above, of both sexes, affiliated with Brimex and Amistad Primary Care CMABC, residing within the geographic radius of the Clinics; with socioeconomic vulnerability according to the classification criteria of the Official Gazette of the Federation[9]; possessing a smartphone and/or computer; access to WIFI, and in the case of older adults or those with disabilities (difficulty in mobility, vision, or hearing), having a primary caregiver; having one or more non-communicable chronic diseases, diagnosed according to national and international medical regulations and guidelines[10-14]. The prevalence of non-communicable chronic diseases in the patient population of the clinics for overweight and obesity is 87%, pre-diabetes 32.6%, Type 1 and 2 diabetes 29.7%, and, hypertension 33%.

Patients participating in other research protocols were excluded. Those with 20% or more absenteeism from the HCM were also eliminated.

Process of the HCM intervention

The implementation of the HCM began during the SARS-CoV-2 pandemic period and continues to the present day to complete the 48-month follow-up, with the allocated budget for patient care by Centro Médico ABC and from volunteers and collaborations of Centro Médico ABC.

Once patients agreed to participate in the HCM, they were provided with a scheduling card for appointments, a kit containing monitoring equipment: ACCU-CHEK Instant® glucometer, Omron® blood pressure monitor, Inhala Care FS10/FS20® oximeter, Andromeda INC® Digital Body Scale, Ross measuring tape, and a monitoring record notebook. the multidisciplinary team trained patients on the proper use of the equipment and monitoring recording.

The HCM consists of three elements: (1) Telehealth consultations, (2) in-person consultations, and (3) health education (Fig. 1).

1. Telehealth consultations: these involve telephone calls at a pre-established time in real-time for the follow-up of patients with stable chronic diseases. Diagnostic auxiliary results were reviewed. The healthcare professional recorded the information in the Sherpa electronic medical record. Telehealth consultations were standardized with the following key points (Table 1). Patients were trained in communication device management and the use of platforms for telehealth connection such as WhatsApp®, Google Meet®, Zoom®, and Moodle®. Tecnológico de Monterrey collaborated in the development and support of the electronic medical record in the Sherpa® platform and in training clinicians and administrators for its use[15].

   The frequency of the medicine and nutrition telehealth consultations is 8/person/year; psychology and dentistry 1/person/year; and pharmacy as necessary when referred by the physician.
2. In-person consultations in medicine, nutrition, dentistry, psychology, pharmacy, and nursing were conducted following institutional operational norms for medical care consulting rooms and standards of care regulated by national entities such as the Ministry of Health[16] and international bodies, such as the Joint Commission International, ensuring quality, safety, and warmth in care provision.
   - Medicine: anamnesis and physical examination were performed, along with a review of diagnostic auxiliary studies and therapeutic prescription. Therapeutic goals were established jointly with the patient. The frequency of the medicine in-person consultations is 4/person/year.
   - Psychology: consultation was provided as necessary when referred by the physician upon detecting patients with altered scores in BECK inventories for anxiety[17] and depression[18]. It consisted of 10 individual session's in-person or remotely based on the patient's mobility capabilities.
   - Nutrition: an interview was conducted to complete the nutritional medical history and perform anthropometric, biochemical, clinical, dietary, and functional evaluations. A nutritional treatment plan and supplementation were established according to the patient's medical-nutritional requirements and diagnoses[19]. The frequency of the medicine in-person consultations is 3/person/year.

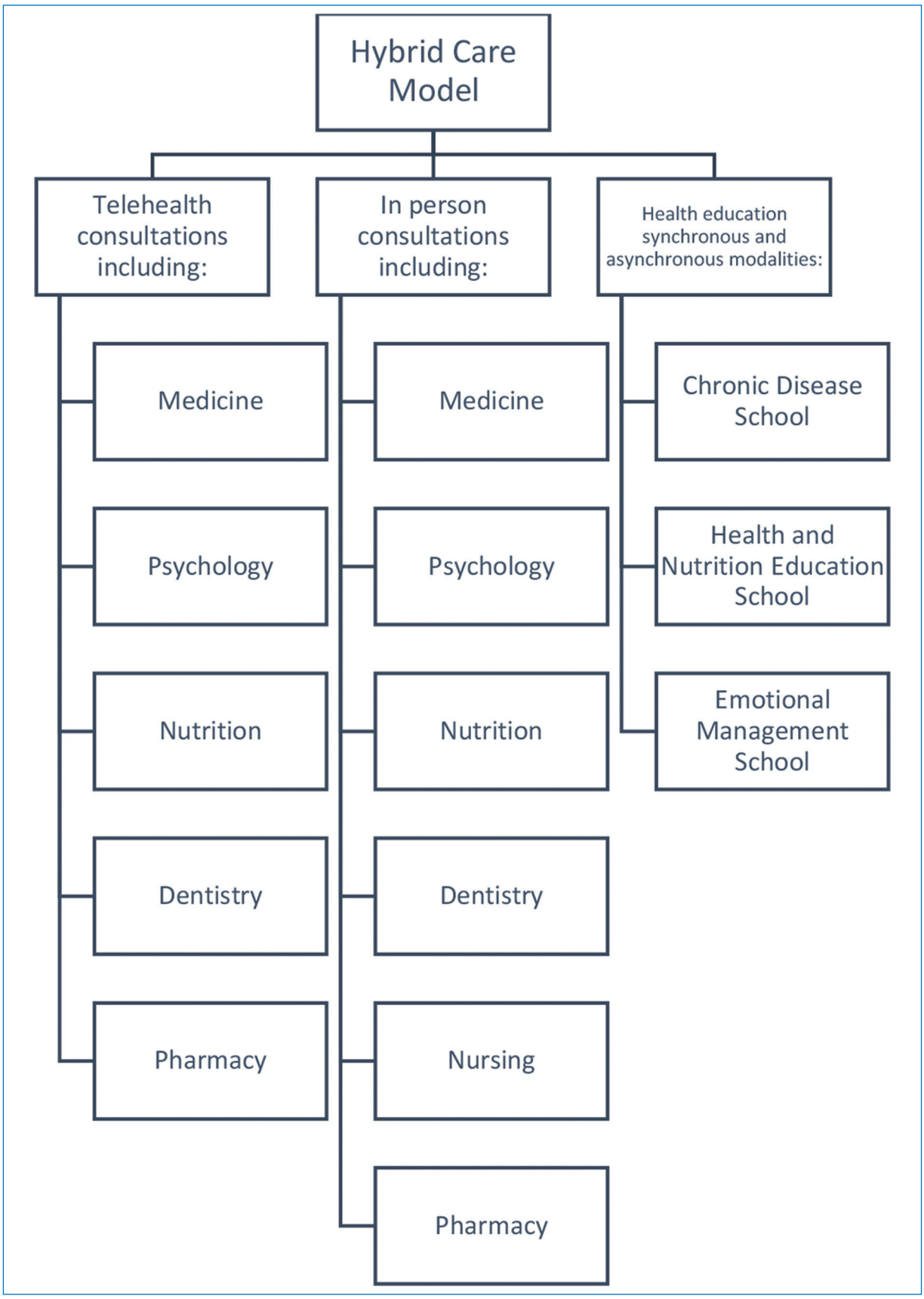

Figure 1. Hybrid care model components.

Table 1. Keypoints in telehealth consultations

Phase	Patient	Healthcare professional
Before consultation	The patient received technological training on the use of apps. The patient validated a stable internet connection and was connected in a quiet place with good lighting	The healthcare provider reviewed and analyzed the patient's medical record and diagnostic aids
During consultation	The patient provided information from their previous medical records and kept their medications available	The healthcare provider conducted a comprehensive patient interview through empathetic, assertive, and compassionate communication
After consultation	The patient attended all scheduled follow-up appointments as stipulated in their medical record	The healthcare provider documented the patient's information in the electronic medical record. They also astutely recognized when an in-person consultation was necessary

- Dentistry: periodontal disease presence was evaluated, and a therapeutic intervention plan was defined based on the Mexican Periodontology Association criteria[20]. The frequency of the medicine in-person consultations is 1/person/year.
- Nursing: hospital triage was conducted for preliminary clinical assessment, stratifying patients based on urgency level to improve service quality. Vital signs were taken at each visit across all specialties[21]. The frequency of the medicine in-person consultations is 7/person/year.
- Pharmacy: education and dispensation of medications were carried out according to guidelines and norms for treating the patient's underlying conditions. The frequency of the medicine in-person consultations is 4/person/year.

3. Health education was provided synchronously and asynchronously. There are three groups of health education:
   - Chronic disease school, consisting of 18 classes to disseminate self-care knowledge based on evidence-based models of self-management education. The classes are synchronous and in-person, simultaneously transmitted remotely on Google Meet®. Patients with difficulty to assist were offered the alternative of reviewing classes on the Moodle® platform[22].
   - Health and nutrition education school, focused on overweight and obesity prevention and treatment, based on the components of the Edmonton Obesity Staging System, and delivered by a multidisciplinary team (medicine, nutrition, physical therapy, psychology, and clinical gastronomy)[23].
   - Emotional management school, delivered in-person by psychologists to patients with mild anxiety and/or depression alterations in 10 sessions.

Data analysis plan

It involves descriptive statistics for the demographic and clinical characteristics of the study population. Hospitalization and emergency service admission prevalence will be estimated, as well as acute conditions in the clinics. In addition, analysis of variables from laboratory tests (total cholesterol, high-density lipoprotein cholesterol, glycated hemoglobin, fasting glucose, fasting insulin, homeostatic model assessment of insulin resistance, leptin, creatinine, and microalbuminuria), clinical evaluation (body weight, height, body mass index, systolic and diastolic blood pressure, periodontal disease) and medical history (treatment for hypertension, treatment for diabetes, smoking history, cardiovascular risk score, cardiovascular age and anxiety and depression assessment with beck inventory) will be run.

Both bivariate and multivariate analyses will be employed to assess relationships between variables. If the data are determined to be normally distributed, parametric tests, such as Pearson's correlation coefficient for bivariate analysis and techniques, such as linear regression or analysis of variance for multivariate analysis will be used. If the study sample is not normally distributed, non-parametric tests will be employed. Non-parametric bivariate tests include Spearman's rank correlation coefficient, while Kruskal-Walli's test or Mann-Whitney U test will be used for multivariate analysis.

Statistical analyses will be conducted using the IBM Statistical Package for the Social Sciences version 27. The level of significance will be set at (α) = 0.05. For all hypothesis tests, 95% confidence intervals will be reported.

Discussion

The history of the American British Cowdray Hospital dates to 1886 when the American Hospital was

inaugurated in Mexico City thanks to philanthropists who donated the land to build the hospital. Subsequently, in 1923, Mr. Weetman Pearson and his wife Mrs. Annie Cass, Lord, and Lady Cowdray contributed to the inauguration of the Cowdray Sanatorium. This Sanatorium became known as the English Hospital due to the nationality of Lady and Lord Cowdray[24].

CMABC was created 80 years ago as a result of the merger of these two sanatoriums, created with the intention of assisting the most vulnerable, leading to the establishment of the American British Cowdray Hospital, a Private Assistance Institution, in 1941. CMABC is governed by a Board of Trustees and uses its financial surplus to support and care for economically vulnerable communities through disease prevention programs, surgeries, and high-specialty treatments. Within the Brimex and Amistad Clinics, the CMABC offers primary care to patients with non-communicable chronic diseases. In addition, the Voluntary Ladies Group (1953) was created, which altruistically generates fundraising campaigns for the benefit of these vulnerable patients[24].

Addressing the issue of the SARS-CoV-2-19 pandemic meant redesigning the activities of the Brimex and Amistad Clinics at CMABC to continue caring for their patients while also containing the spread of the disease. The containment measure recommended by the World Health Organization (WHO) consisted of population confinement, which hindered patient follow-up in the traditional care model. Faced with this need, a hybrid follow-up scheme was developed in the community clinics. Healthcare professionals attended to patients remotely, and only when urgent issues were detected were they asked to come to the clinics in person[24,25].

The objective of this article was to present the framework of the HCM for the development of future publications regarding its effectiveness. There are few national-level studies that support the use of hardware management console with a multidisciplinary component for managing chronic diseases[25]. It has been demonstrated that the HCM is a useful tool; its suitability linked to a variety of factors related to resources, patient preferences, and specific health conditions[3].

The HCM offers several advantages for both patients and the healthcare system. It aids in the timely diagnosis and control of chronic diseases through continuous patient monitoring, leading to a reduction in complications and an improvement in quality of life[2].

We highlight three advantages of the HCM: (1) impact on therapeutic adherence: The HCM can help improve patients' therapeutic adherence. According to the WHO, therapeutic adherence supports patients by providing reminders that facilitate medication intake and lifestyle changes[26]; (2) reducing patient expenses for hospital visits, as it has been reported that telemedicine clinicians can resolve issues around 60% of the time; (3) contribution to environmental sustainability by reducing the need for travel[1].

Among the disadvantages of the HCM are technical barriers such as difficulty in using technological devices and accessing WIFI networks for telehealth, as well as the challenge of accessing in-person appointments when the patient does not have a caregiver or family member accompanying them[25,27].

Conclusion

This publication provides the framework to demonstrate the impact in future publications of a HCM program in an urban community with socioeconomic vulnerability. The HCM is an effective measure for continuity of care during challenging times such as the SARS-CoV-2 pandemic. This allows for the establishment of new forms of care in the post-pandemic state for patients with chronic conditions.

Acknowledgments

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that the procedures followed complied with the ethical standards of the responsible human experimentation committee and adhered to the World Medical

Association and the Declaration of Helsinki. The procedures were approved by the institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from patients. The SAGER guidelines were followed according to the nature of the study. This project has received ethics approval from the Centro Médico ABC Research Ethics Committee (approval numbers ABCS-08-10, ABC-19-34).

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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