SHEBA BEYOND
Your Virtual Hospital

Research Studies on Telemedicine

Sheba Medical Center

Version 1 - 2024

Research Studies on Telemedicine
Sheba Medical Center

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Dear Colleagues and Readers,

I am excited to share with you this comprehensive booklet, which highlights research studies conducted at Sheba Medical Center on remote care and telemedicine mainly from the past four years. As a pioneering institution in the field of remote care, we understand that the future of healthcare lies not only in the innovative delivery of services but also in the rigorous evaluation of their efficacy, safety, and impact on patient outcomes. Every study in this booklet represents our dedication to understanding how remote care impacts clinical outcomes, patient well-being, and overall healthcare efficiency.

Sheba BEYOND is Sheba Medical Center's 5th hospital and Israel's first virtual hospital. Established in 2020 with the outbreak of the Covid-19 virus, we provide patients with world-class medical treatment and remote care services including home hospitalization, chronic patient monitoring, post-op care, and preventative care. Remote care has rapidly transformed how we provide medical services, particularly by enhancing accessibility, convenience, and continuity of care for patients, regardless of their location. New remote care models, including remote ambulatory services, hybrid clinic, continuous monitoring programs and hospital-at-home, are developed in order to meet the unmet needs of the healthcare system.

However, implementing these new models of care requires more than just technological innovation it demands a thorough and scientific investigation into their effectiveness and impact on outcomes. Only by validating new care models and technology through research can we ensure that they deliver meaningful clinical and functional outcomes for patients. The studies included in this booklet underscore the importance of critically evaluating both the benefits and limitations of remote care, ensuring that our approach remains patient-centered and clinically sound.

It is vital that healthcare provides foster a culture of research—a culture where inquiry, evaluation, and continuous improvement are embedded in every aspect of care delivery. Through research, we empower healthcare professionals to challenge the status quo, drive innovation, and improve the quality of care for all.

My vision for the future is to see every healthcare provider, clinician, and researcher in Sheba and other healthcare organizations in Israel and around the world actively engaged in this pursuit of excellence. Let us continually challenge ourselves to ask the hard questions, to explore new solutions, and to push the boundaries of what is possible in healthcare. By doing so, we will not only improve the lives of our patients but also shape the future of medicine.

Sincerely,
Dr. Galia Barkai
Director, Sheba BEYOND Virtual Hospital

Section 1: Published Articles

Internal Medicine Hospital-at-Home

Assessment of Consensus Level Between Imaging Specialists, Internal Medicine Specialists and Artificial Intelligence Software Regarding Chest X-Rays Done as Part of Hospital at Home Service: Prospective Observational Study

Eitan Grossbard; Yehonatan Marziano; Adam Sharabi; Eliyahu Abutbul; Aya Berman; Reut Kassif-Lerner; Galia Barkai; Hila Hakim; Gad Segal. JMIR Formative Research. 2024; 8:e55916 (copyediting).

Abstract:
Background: Home hospitalization is a modality growing in popularity worldwide. Telemedicine-controlled, hospital at home (HAH) services could replace traditional in-hospital departments for selected patients. The clinical data for such cases typically involves chest X-rays.
Objective: The implementation, analysis and clinical assimilation of this modality into a HAH service has not been described yet. Our objective is to add this essential information to the realm of hospital-at-home, worldwide.
Methods: A prospective follow-up, description, and analysis of our HAH patients' population who underwent chest X-ray at home. We conducted a comparative analysis evaluating the level of agreement among three modalities: an imaging specialist, the attending physician and a designated algorithm of artificial intelligence (AI).
Results: Between February 2021 and May 2023, 300 chest radiographs were performed at the homes of 260 patients with a median age of 78 years [IQR 65 – 87]. 95% of the X-rays were interpreted by the attending physician, round 10% by a specialized radiologist, and ~32% by an AI software. The raw agreement level among these three modalities was over 90%. The consensus level using the Cohen's Kappa coefficient (Ķ) showed substantial agreement (Ķ value of 0.65) and moderate agreement (Ķ value of 0.49) between the attending physician and the radiologist, as well as between the attending physician and the AI, respectively.
Conclusions: Chest X-rays play a crucial role in the HAH setting. Interpretation by an experienced specialist in internal medicine demonstrates significant level of consensus with imaging specialists. However, interpretation by AI algorithms should be further developed and re-validated prior to clinical applications.

Tele-medicine controlled hospital at home is associated with better outcomes than hospital stay.

Zychlinski N, Fluss R, Goldberg Y, Zubli D, Barkai G, Zimlichman E, Segal G
PLoS One. 2024 Aug 19;19(8):e0309077.

Abstract:
Background: Hospital-at-home (HAH) is increasingly becoming an alternative for in-hospital stay in selected clinical scenarios. Nevertheless, there is still a question whether HAH could be a viable option for acutely ill patients, otherwise hospitalized in departments of general-internal medicine.
Methods: This was a retrospective matched study, conducted at a telemedicine controlled HAH department, being part of a tertiary medical center. The objective was to compare clinical outcomes of acutely ill patients (both COVID-19 and non-COVID) admitted to either in-hospital or HAH. Non-COVID patients had one of three acute infectious diseases: urinary tract infections (UTI, either lower or upper), pneumonia, or cellulitis.
Results: The analysis involved 159 HAH patients (64 COVID-19 and 95 non-COVID) who were compared to a matched sample of in-hospital patients (192 COVID-19 and 285 non-COVID). The median length-of-hospital stay (LOS) was 2 days shorter in the HAH for both COVID-19 patients (95% CI: 1-3; p = 0.008) and non-COVID patients (95% CI; 1-3; p < 0.001). The readmission rates within 30 days were not significantly different for both COVID-19 patients (Odds Ratio (OR) = 1; 95% CI: 0.49-2.04; p = 1) and non-COVID patients (OR = 0.7; 95% CI; 0.39-1.28; p = 0.25). The differences remained insignificant within one year. The risk of death within 30 days was significantly lower in the HAH group for COVID-19 patients (OR = 0.34; 95% CI: 0.11-0.86; p = 0.018) and non-COVID patients (OR = 0.38; 95% CI: 0.14-0.9; p = 0.019). For one year survival period, the differences were significant for COVID-19 patients (OR = 0.5; 95% CI: 0.31-0.9; p = 0.044) and insignificant for non-COVID patients (OR = 0.63; 95% CI: 0.4-1; p = 0.052).
Conclusions: Care for acutely ill patients in the setting of telemedicine-based hospital at home has the potential to reduce hospitalization length without increasing readmission risk and to reduce both 30 days and one-year mortality rates.

Can Patients with Electrolyte Disturbances Be Safely and Effectively Treated in a Hospital-at-Home, Telemedicine-Controlled Environment? A Retrospective Analysis of 267 Patients.

Cohn May, Gueron Or , Segal Gad , Zubli Daniel , Hakim Hila , Fizdel Boris , Liber Pninit , Amir Hadar, Barkai Galia , J Clin Med, 2024 Feb 29;13(5):1409.

Abstract:
Background: Morbidities indicated for hospital-at-home (HAH) treatment include infectious diseases and exacerbations of chronic conditions. Electrolyte disturbances are not included per se. However, their rate is high. We aimed to describe our experience via the monitoring and treatment of such patients.
Methods: This was a retrospective analysis of patients in the setting of telemedicine-controlled HAH treatment. We collected data from the electronic medical records of patients who presented electrolyte disturbances.
Results: For 14 months, we treated 267 patients in total in HAH settings, with a mean age of 72.2 + 16.4, 44.2% for males. In total, 261 (97.75%) patients were flagged with electrolyte disturbances, of whom 149 had true electrolyte disturbances. Furthermore, 67 cases (44.96%) had hyponatremia, 9 (6.04%) had hypernatremia after correction for hyperglycemia, 20 (13.42%) had hypokalemia and 27 (18.12%) had hyperkalemia after the exclusion of hemolytic samples. Ten (6.09%) patients had hypocalcemia and two (1.34%) had hypercalcemia corrected to albumin levels. Thirteen (8.72%) patients had hypomagnesemia and one (0.67%) had hypermagnesemia. Patients with electrolyte disturbances suffered from more chronic kidney disease (24.2% vs. 12.2%; $p = 0.03$) and malignancy (6.3% vs. 0.6%; $p = 0.006$), and were more often treated with diuretics (12.6% vs. 4.1%; $p = 0.016$). No patient died or suffered from clinically significant cardiac arrhythmias.
Conclusions: The extent of electrolyte disturbances amongst HAH treatment patients is high. The monitoring and treatment of such patients can be conducted safely in this setting.

Designing for flexibility in hybrid care services: lessons learned from a pilot in an internal medicine unit.

Pilosof NP, Barrett M, Oborn E, Barkai G, Zimlichman E, Segal G.Front Med Technol. 2023 Nov 20;5:1223002

Abstract:
Digital transformation in healthcare during the COVID-19 pandemic led to the development of new hybrid models integrating physical and virtual care. The ability to provide remote care by telemedicine technologies and the need to better manage and control hospitals' occupancy accelerated growth in hospital-at-home programs. The Sheba Medical Center restructured to create Sheba Beyond as the first virtual hospital in Israel. These transformations enabled them to deliver hybrid services in their internal medicine unit by managing inpatient hospital-care with remote home-care based on the patients' medical condition. The hybrid services evolved to integrate care pathways multiplied by the mode of
delivery-physical (in person) or virtual (technology enabled)-and the location of care-at the hospital or the patient home. The study examines this home hospitalization program pilot for internal medicine at Sheba Medical Center (MC). The research is based on qualitative semi-structured interviews with Sheba Beyond management, medical staff from the hospital and the Health Maintenance Organization (HMO), Architects, Information Technology (IT), Telemedicine and Medtech organizations. We investigated the implications of the development of hybrid services for the future design of the physical built-environment and the virtual technological platform. Our findings highlight the importance of designing for flexibility in the development of hybrid care services, while leveraging synergies across the built environment and digital platforms to support future models of care. In addition to exploring the potential for scalability in accelerating the flexibility of the healthcare system, we also highlight current barriers in professional, management, logistic and economic healthcare models.

Six-Lead Electrocardiography Enables Identification of Rhythm and Conduction Anomalies of Patients in the Telemedicine-Based, Hospital-at-Home Setting: A Prospective Validation Study.

Sharabi A, Abutbul E, Grossbard E, Martsiano Y, Berman A, Kassif-Lerner R, Hakim H, Liber P, Zoubi A, Barkai G, Segal G. Sensors (Basel). 2023 Oct 14;23(20):8464.

Abstract:
Background: The hospital-at-home (HAH) model is a viable alternative for conventional in-hospital stays worldwide. Serum electrolyte abnormalities are common in acute patients, especially in those with many comorbidities. Pathologic changes in cardiac electrophysiology pose a potential risk during HAH stays. Periodical electrocardiogram (ECG) tracing is therefore advised, but few studies have evaluated the accuracy and efficiency of compact, self-activated ECG devices in HAH settings. This study aimed to evaluate the reliability of such a device in comparison with a standard 12-lead ECG.
Methods: We prospectively recruited consecutive patients admitted to the Sheba Beyond Virtual Hospital, in the HAH department, during a 3-month duration. Each patient underwent a 12-lead ECG recording using the legacy device and a consecutive recording by a compact six-lead device. Baseline patient characteristics during hospitalization were collected. The level of agreement between devices was measured by Cohen's kappa coefficient for inter-rater reliability (Ķ).
Results: Fifty patients were included in the study (median age 80 years, IQR 14). In total, 26 (52%) had electrolyte disturbances. Abnormal D-dimer values were observed in 33 (66%) patients, and 12 (24%) patients had elevated troponin values. We found a level of 94.5% raw agreement between devices with regards to nine of the options included in the automatic read-out of the legacy device. The calculated Ķ was 0.72, classified as a substantial consensus. The rate of raw consensus regarding the ECG intervals' measurement (PR, RR, and QT) was 78.5%, and the calculated Ķ was 0.42, corresponding to a moderate level of agreement.
Conclusion: This is the first report to our knowledge regarding the feasibility of using a compact, six-lead ECG device in the setting of an HAH to be safe and bearing satisfying agreement level with a legacy,
12-lead ECG device, enabling quick, accessible arrythmia detection in this setting. Our findings bear a promise to the future development of telemedicine-based hospital-at-home methodology.

Interpretation of Heart and Lungs Sounds Acquired via Remote, Digital Auscultation Reached Fair-to-Substantial Levels of Consensus among Specialist Physicians.

Magor D, Berkov E, Siomin D, Karniel E, Lasman N, Waldman LR, Gringauz I, Stern S, Kassif RL, Barkai G, Lewy H, Segal G.Diagnostics (Basel). 2023 Oct 9;13(19):3153.

Abstract:

Background: Technological advancement may bridge gaps between long-practiced medical competencies and modern technologies. Such a domain is the application of digital stethoscopes used for physical examination in telemedicine. This study aimed to validate the level of consensus among physicians regarding the interpretation of remote, digital auscultation of heart and lung sounds.

Methods: Seven specialist physicians considered both the technical quality and clinical interpretation of auscultation findings of pre-recorded heart and lung sounds of patients hospitalized in their homes. TytoCare™ system was used as a remote, digital stethoscope.

Results: In total, 140 sounds (70 heart and 70 lungs) were presented to seven specialists. The level of agreement was measured using Fleiss' Kappa (FK) variable. Agreement relating to heart sounds reached low
to-moderate consensus: the overall technical quality (FK = 0.199), rhythm regularity (FK = 0.328), presence of murmurs (FK = 0.469), appreciation of sounds as remote (FK = 0.011), and an overall diagnosis as normal or pathologic (FK = 0.304). The interpretation of some of the lung sounds reached a higher consensus: the overall technical quality (FK = 0.169), crepitus (FK = 0.514), wheezing (FK = 0.704), bronchial sounds (FK = 0.034), and an overall diagnosis as normal or pathological (FK = 0.386). Most Fleiss' Kappa values were in the range of "fare consensus", while in the domains of diagnosing lung crepitus and wheezing, the values increased to the "substantial" level.

Conclusions: Bio signals, as recorded auscultations of the heart and lung sounds serving the process of clinical assessment of remotely situated patients, do not achieve a high enough level of agreement between specialized physicians. These findings should serve as a catalyzer for improving the process of telemedicine-attained bio-signals and their clinical interpretation.

Occult myocardial injury is prevalent amongst elderly patients in the hospital-at-home setting. A retrospective analysis of 213 patients.

Marziano Y, Abutbul E, Sharabi A, Grossbard E, Berman A, Kassif-Lerner R, Barkai G, Hakim H, Segal G. Int J Cardiol Cardiovasc Risk Prev. 2023 Sep 23;19:200215.

Abstract:
Background: Hospital-at-Home (HAH) is a valid alternative for in-hospital stay for a wide variety of clinical indications. Occult myocardial injury, associated with acute illness, mainly occurs in patients with a background of non-obstructive coronary disease. The aim of this study was to describe the prevalence of this phenomenon in our HAH population.
Methods: A retrospective description and analysis of data collected for patients admitted to the Sheba beyond's HAH services during 14 months.
Results: During a period of 14 months (7/10/21-6/12/22), blood troponin measurements were available for 213 patients (median age 78 years, 52% males) hospitalized mainly for infectious causes. The median HS (highly sensitive) troponin level was 7.7 ng/L (IQR = 13.2 ng/L) (the normal upper limit is 12 ng/L) with 31% of all patients demonstrating an abnormally increased troponin level (68/213). Of all patients, 64% had a background diagnosis of a cardiovascular disease (138/213), of whom, 49% had abnormal HS troponin levels (68/138). No patient suffered from acute cardiac function deterioration and no patient died during their hospital-at-home stay.
Conclusion: The prevalence of occult myocardial injury amongst elderly patients admitted to hospital-at-home stay for diagnoses other than myocardial infarction is relatively high but it is not associated with worse short-term clinical outcomes.

Developing and validating a machine learning prognostic model for alerting to imminent deterioration of hospitalized patients with COVID-19.

Kogan Y, Robinson A, Itelman E, Bar-Nur Y, Jakobson DJ, Segal G, Agur Z.Sci Rep. 2022 Nov 10;12(1):19220.

Abstract:
Our study was aimed at developing and validating a new approach, embodied in a machine learning-based model, for sequentially monitoring hospitalized COVID-19 patients and directing professional attention to patients whose deterioration is imminent. Model development employed real-world patient data (598 prediction events for 210 patients), internal validation (315 prediction events for 97 patients), and external validation (1373 prediction events for 307 patients). Results show significant divergence in longitudinal values of eight routinely collected blood parameters appearing several days before deterioration. Our model uses these signals to predict the personal likelihood of transition from non-severe to severe status within well-specified short time windows. Internal validation of the model's prediction accuracy showed ROC AUC of 0.8 and 0.79 for prediction scopes of 48 or 96 h, respectively; external validation showed ROC AUC of 0.7 and 0.73 for the same prediction scopes. Results indicate the feasibility of predicting the forthcoming deterioration of non-severe COVID-19 patients by eight routinely collected blood parameters, including neutrophil, lymphocyte, monocyte, and platelets counts, neutrophil-to-lymphocyte ratio, CRP, LDH, and D-dimer. A prospective clinical study and an impact assessment will allow implementation of this model in the clinic to improve care, streamline resources and ease hospital burden by timely focusing the medical attention on potentially deteriorating patients.

"Staying at Home": A pivotal trial of telemedicine-based internal medicine hospitalization at a nursing home.

Barkai G, Amir H, Dulberg O, Itelman E, Gez G, Carmon T, Merhav L, Zigler S, Atamne A, Pinhasov O, Zimlichman E, Segal G. Digit Health. 2022 Sep 15;8

Abstract:

Background: In-hospital stay of acutely ill elderlies could be reduced by increasing the availability of community-based hospitalizations. The feasibility of remotely managing these patients by specialized internists, without leaving their nursing homes should be sought. In the current pivotal study, we aimed to evaluate the aforementioned model.

Methods: This was a prospective, open-label study at a tertiary medical center and a nursing home. The study aimed at comparing clinical outcomes of patients hospitalized in each location.

Results: Over a period of 5.5 months, we recruited 18 patients designated for hospitalization, meeting our inclusion criteria to either in-hospital stay or staying in their nursing home and treated by means of telemedicine from our tertiary medical center. The mean age was 85.3 years. Out of 114 hospitalization days, 44 days (48%) were at the nursing home. No significant difference was noted in terms of age, gender, and length of stay between the patients who were hospitalized in either location. In almost all cases, diagnosis changed during hospitalization. Three patients died during the study, all included in the in-hospital group. No safety breaching events happened in the nursing home-hospitalization group.

Conclusions: Remote, telemedicine-based hospitalization of nursing home-dwelling elderlies is safe and feasible, potentially reducing the length of in-hospital stay by almost 50%. Larger studies in this realm are warranted.

Assessing the Usability of a Novel Wearable Remote Patient Monitoring Device for the Early Detection of In-Hospital Patient Deterioration: Observational Study.

Itelman E, Shlomai G, Leibowitz A, Weinstein S, Yakir M, Tamir I, Sagiv M, Muhsen A, Perelman M, Kant D, Zilber E, Segal G. JMIR Form Res. 2022 Jun 9;6(6):e36066.

Abstract:

Background: Patients admitted to general wards are inherently at risk of deterioration. Thus, tools that can provide early detection of deterioration may be lifesaving. Frequent remote patient monitoring (RPM) has the potential to allow such early detection, leading to a timely intervention by health care providers.

Objective: This study aimed to assess the potential of a novel wearable RPM device to provide timely alerts in patients at high risk for deterioration.

Methods: This prospective observational study was conducted in two general wards of a large tertiary medical center. Patients determined to be at high risk to deteriorate upon admission and assigned to a telemetry bed were included. On top of the standard monitoring equipment, a wearable monitor was attached to each patient, and monitoring was conducted in parallel. The data gathered by the wearable monitors were analyzed retrospectively, with the medical staff being blinded to them in real time. Several early warning scores of the risk for deterioration were used, all calculated from frequent data collected by the wearable RPM device: these included (1) the National Early Warning Score (NEWS), (2) Airway, Breathing, Circulation, Neurology, and Other (ABCNO) score, and (3) deterioration criteria defined by the clinical team as a "wish list" score. In all three systems, the risk scores were calculated every 5 minutes using the data frequently collected by the wearable RPM device. Data generated by the early warning scores were compared with those obtained from the clinical records of actual deterioration among these patients.

Results: In total, 410 patients were recruited and 217 were included in the final analysis. The median age was 71 (IQR 62-78) years and 130 (59.9%) of them were male. Actual clinical deterioration occurred in 24 patients.

The NEWS indicated high alert in 16 of these 24 (67%) patients, preceding actual clinical deterioration by 29 hours on average. The ABCNO score indicated high alert in 18 (75%) of these patients, preceding actual clinical deterioration by 38 hours on average. Early warning based on wish list scoring criteria was observed for all 24 patients 40 hours on average before clinical deterioration was detected by the medical staff. Importantly, early warning based on the wish list scoring criteria was also observed among all other patients who did not deteriorate.

Conclusions: Frequent remote patient monitoring has the potential for early detection of a high risk to deteriorate among hospitalized patients, using both grouped signal-based scores and algorithm-based prediction. In this study, we show the ability to formulate scores for early warning by using RPM. Nevertheless, early warning scores

compiled on the basis of these data failed to deliver reasonable specificity. Further efforts should be directed at improving the specificity and sensitivity of such tools.

Remote Auscultation of Heart and Lungs as an Acceptable Alternative to Legacy Measures in Quarantined COVID-19 Patients-Prospective Evaluation of 250 Examinations.

Haskel O, Itelman E, Zilber E, Barkai G, Segal G.Sensors (Basel). Sensors (Basel), 2022, Apr 20;22(9):3165

Abstract:
The COVID-19 pandemic accelerated the assimilation of telemedicine platforms into medical practice. Nevertheless, research-based evidence in this field is still accumulating. This was a prospective, cross-sectional comparative assessment of a remote physical examination device used mainly for heart and lung digital auscultation. We analyzed usage patterns, user (physician) subjective appreciation and compared it to legacy measures. Eighteen physicians (median age 36 years (IQR 32-45): two interns, seven residents and nine senior physicians; eleven internists, five geriatricians and two pediatricians) executed over 250 remote physical examinations. Their median work duration with quarantined patients was 60 days (IQR 45-60). The median number of patients examined by a single physician was 17 (IQR 10-34). Regarding overall estimation, all participants tended to prefer the remote examination in the setting of quarantined patients (median 6, IQR 3.75-8), while no statistically significant difference was demonstrated compared to the indifference value (p = 0.122). Internists preferred tele-medical examination over non-internists, with significant differences between groups regarding heart auscultation, (median 7, (IQR 3-7) vs. median 2, (IQR 1-5, respectively)), p = 0.044. In the setting of quarantined patients, from the physicians' perspective, a digital platform for remote auscultation of heart and lungs was considered as an acceptable alternative to legacy measures.

Remote Glucose Monitoring of Hospitalized, Quarantined Patients With Diabetes and COVID-19.

Shehav-Zaltzman G, Segal G, Konvalina N, Tirosh A. Diabetes Care, 2020 Jul;43(7):e75-e76.

Abstract:
The rapid growth in diagnosed patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) led to national directives for hospital emergency preparedness. Sheba Medical Center, a government hospital in Israel, undertook emergency measures to expand the inpatient quarantine capacity and converted two general medical wards to isolation wards with enhanced ventilation support capabilities.
Diabetes is associated with increased severity, complications, and mortality from coronavirus disease 2019 (COVID-19). The care of patients with diabetes under strict isolation poses significant competing challenges of maintaining adequate quality of care achieved by multiple daily glucose measurements while minimizing risk of staff exposure, highlighting timely blood glucose management for the COVID-19 outbreak as an urgent need. To prevent patient-staff transmission while maintaining standard of care for hospitalized patients with diabetes, a way to monitor glucose levels remotely—from outside the designated isolated rooms—is required.
We report our experience in activating five monitoring stations per department based on personal continuous glucose monitoring (CGM) systems. We used CGM transmitters (Guardian Connect, MMT-7820ME; Medtronic) connected to glucose sensors (Enlite, MMT-7020; Medtronic) transmitting glucose values every 5 min through Bluetooth connectivity to designated mobile devices that upload data to the web through a Guardian Connect application. Real-time glucose monitoring in the control, viral-free area was viewed continuously by the team using CareLink personal websites. To allow data visualization of several patients on one control screen, the CareLink personal websites were accessed via different browsers and minimized to allow a view of real-time continuous glucose levels of up to four patients on a single screen. Training for physicians and nurses was provided by trained staff from the hospital's Division of Endocrinology, Diabetes and Metabolism. Teams were also provided with educational material and designated short videos for weekly replacement of sensors and instructions for timely calibrations. Calibrations were performed twice daily.
The request for remote glucose monitoring was made by the hospital on 18 March, and all monitoring stations were fully operational the following day. The first subjects who completed a week of remote glucose monitoring were one patient with type 1 diabetes on continuous subcutaneous insulin infusion and three patients with type 2 diabetes on a basal-bolus insulin regimen. Mean ± SD daily glucose measurements decreased from 3.75 ± 0.86 to 1.94 ± 0.31 with remote CGM (P = 0.005), with significant improvement in mean glucose levels from 258.2 ± 25.3 to 169.3 ± 7.9 mg/dL, respectively, P = 0.0006.The main challenges included training alternating

teams with the calibration procedure and cost. The analysis and report of the data were approved by the Institutional Review Board of Sheba Medical Center.
In summary, converting a personal CGM system originally designed for diabetes self-management to team-based, real-time remote glucose monitoring offers a novel tool for inpatient diabetes control in COVID-19 isolation facilities. Such a solution in addition to ongoing remotely monitored clinical parameters (such as pulse rate, electrocardiogram, and oxygen saturation) adds to quality of diabetes care while minimizing risk of staff exposure and burden.

Remote High-Risk Pregnancy Monitoring

Integrating technologies to provide comprehensive remote fetal surveillance: A prospective pilot study

Omer Nir , Gur Dvir , Esther Galler, Michal Axelrod , Adel Farhi , Galia Barkai , Boaz Weisz , Eyal Sivan , Shali Mazaki Tovi, Abraham Tsur. Int J Gynaecol Obstet, 2024 Feb;164(2):662-667.

Abstract:
Objective: To determine the feasibility of extending remote maternal-fetal care to include fetus well-being.
Methods: The authors performed a prospective pilot study investigating low-risk pregnant participants who were recruited at the time of their first full-term in-person visit and scheduled for a follow-up telemedicine visit. Using novel self-operated fetal monitoring and ultrasound devices, fetal heart monitoring and amniotic fluid volume measurements were obtained to complete a modified biophysical profile (mBPP). Total visit length was measured for both the in-person first visit and the subsequent telemedicine encounter. A patient satisfaction survey form was obtained.
Results: Ten women between 40 + 1 and 40 + 6 weeks of gestation participated in telemedicine encounters. Nine women (90%) were able to complete remote mBPP assessment. For one participant, fetal assessment was not completed due to technically inconclusive fetal monitoring. Another participant was referred for additional assessment in the delivery room. Satisfactory amniotic fluid volume measurements were achieved in 100% of participants. The telemedicine encounter was significantly shorter (93.1 ± 33.1 min) than the in-person visit (247.2 ± 104.7 min; $P < 0.001$). We observed high patient satisfaction.
Conclusion: Remote fetal well-being assessment is feasible and time-saving and results in high patient satisfaction. This novel paradigm of comprehensive remote maternal and fetal assessment is associated with important clinical, socioeconomic, and logistics advantages.

Psychiatry

Technologically assisted intensive home treatment: feasibility study.

Caspi A, Tzur Bitan D, Halaly O, Hallaly O, Friedlander A, Barkai G, Zimlichman E, Stein O, Shani M, Amitai Z, Ansbacher T, Weiser M. Front Psychiatry. 2023 Jul 27:14:1196748

Abstract:
Introduction: In recent year, many attempts have been made to provide patients with alternatives to psychiatric hospitalization during acute distress. Although several hospitalization alternatives have been offered, most of them still require patients to be distanced from their families, friends, and the social environment.
Methods: In this report we describe the implementation of a novel approach to psychiatric care termed "Technologically assisted Intensive Home Treatment", where patients arriving to emergency settings are directed to home care with technological aids that enable close monitoring and ongoing contact with their therapists.
Results: We describe the rationale and treatment principles of the treatment, and provide an elaborative description of the implementation process during the first year of implementation.
Discussion: Additional attention is given to factors associated with early dropout from the program, in order to inform readers of predictors to optimal care. Limitations and directions for future research and practice are discussed.

Internalizing symptoms impede adolescents' ability to transition from in-person to online mental health services during the 2019 coronavirus disease pandemic.

Mekori-Domachevsky E, Matalon N, Mayer Y, Shiffman N, Lurie I, Gothelf D, Dekel I.. J Telemed Telecare. 2023 Oct;29(9):725-730.

Abstract:

Introduction: Online mental health services were previously found to be effective in many studies. However, this method was not generally used in Israel. By the end of 2019, the coronavirus disease 2019 pandemic erupted, forcing mental health services to transition to online meetings to maintain the standard of care. In this cross-sectional study, we investigated the attitudes of adolescent patients toward this involuntary new mode of care.

Methods: Forty-four adolescents (mean age 14.62 ± 2.12 years, 54.5% females) and 40 of their primary caregivers completed a battery of questionnaires that included the telemedicine satisfaction questionnaire, session evaluation questionnaire, working alliance inventory, and pediatric symptom checklist.

Results: Both adolescents and their caregivers reported a reasonable experience with the online medium and a feeling that the meetings were overall powerful, helpful, and comfortable as demonstrated by medium to high scores on the telemedicine satisfaction questionnaire and session evaluation questionnaire questionnaires. A therapeutic alliance was generally maintained according to working alliance inventory scores. However, working alliance inventory scores were negatively correlated with higher levels of internalizing symptoms and parental stress.

Discussion: Our findings point to the possibility that anxious/depressed adolescents will have greater difficulties re-establishing therapeutic alliance when transitioned from in-person to online meetings. This may be due to the introduction of an "invisible" third party to the therapeutic setting-the computer. Psychologists and psychiatrists should be aware of these difficulties and respond adequately to maintain the standard of care.

The emotional-behavioral state of Israeli adolescent and young adult females with anorexia nervosa during the COVID19 pandemic.

Serur Y, Dikstein H, Shilton T, Gothelf D, Latzer Y, Lewis Y, Enoch-Levy A, Pessach I, Gur E, Stein D. J Eat Disord. 2022 Oct 8;10(1):145.

Abstract:
Background: During the COVID-19 pandemic in Israel, the number of patients with eating disorders (EDs) seeking treatment increased significantly. The present study sought to evaluate whether, during the pandemic (2020-21), patients with anorexia nervosa (AN) would show more ED-related, comorbid, and COVID-19-related symptoms in comparison to a naturalistic control group, and whether differences would be found between adult and adolescent patients with AN. We also examined attitudes to telemedicine use during the pandemic in patients receiving long-distance interventions.
Methods: Using online self-report questionnaires, we assessed general and COVID-19-specific symptoms with a secure digital platform (REDCap®) in 36 female adolescents with AN, 35 female adults with AN, and 25 female controls.
Results: Compared with controls, patients with AN showed more symptoms of EDs, anxiety, depression, and post-traumatic stress disorder (PTSD), elevated suicidal ideation, more COVID-related emotional-behavioral disturbances, and lower resilience. Adult patients with AN fared worse than adolescent patients on most of these measures. Adult patients using telemedicine during the COVID-19 pandemic showed fewer positive attitudes toward this treatment than adolescents (telemedicine was offered to all, but used by 18/35 adolescents and 21/36 adults with AN). Last, elevated COVID-19-related symptomatology was correlated with more symptoms of ED, anxiety, depression and PTSD, and with lower resilience.
Conclusions: Our findings suggest that the emotional-behavioral state of Israeli females with AN, particularly adults, was worse during the COVID-19 pandemic in comparison to controls. Many patients did not use telemedicine for their treatment. Adult patients using telemedicine were less satisfied with it than adolescent patients.

Treatment of eating disorders in adolescents during the COVID-19 pandemic: a case series.

Yaffa S, Adi EL, Itai P, Marit JM, Doron G, Daniel S. J Eat Disord. 2021 Feb 10;9(1):17.

Abstract:

Background: Eating disorders (EDs) are among the most difficult psychiatric disorders to treat in normal conditions. They are likely even more difficult to manage in at-risk conditions such as the COVID-19 pandemic. Currently there is limited evidence about the particular needs and recommended treatment of adolescents with EDs during the COVID-19 outbreak, in particular regarding the use of telemedicine and the involvement of the family in long distance-treatment.

Aims: We sought to discuss the advantages and problems associated with the use of multi-professional long-distance telemedicine treatment in the management of adolescents with EDs and their families during the COVID-19 outbreak.

Methods: We gathered data about the treatment of adolescents with EDs in our pediatric ED-treatment center in Israel during the COVID-19 outbreak in the first 10 months of 2020, and compared it to the respective period in the past five years (2015-2019). Second, we described the management of four young females with anorexia nervosa (AN), treated in the ambulatory, daycare and inpatient facilities of our center during the COVID-19 pandemic.

Findings: Slightly less patients were treated in our center during the COVID-19 pandemic than in the respective period in the past five years. These patients received at that time considerably more treatment sessions from all treatment providers (psychiatrists, clinical nutritionists and psychotherapists). This was related, in part, to the extensive use of telemedicine during that period (more than as third of all sessions were carried out with telemedicine in comparison to no use of long-distance treatment in the previous years). The condition of the four adolescents with AN was compromised at the start of the COVID-19 quarantine. The use of multi-disciplinary long-distance telemedicine treatment resulted in an improvement in the condition in three of the four adolescents, living in
well-organized families, with the motivation and ability to adjust to the new conditions, but not in one adolescent whose family experienced more problems. These families might require the use of face-to-face interventions even during pandemic conditions.

Conclusion: The choice of the mode of treatment for adolescents with EDs during pandemic times (telemedicine vs. face-to-face) should consider the functioning of the family.

Neurology & Neurological Tele-rehabilitation

Development and validation of tele-health system for stroke rehabilitation.

Kizony R, Weiss P, Elion O, Harel S, Baum-Cohen I, Krasovsky T, Feldman Y, Shani M. International Journal on Disability and Human Development. 2014;13(3): 361-368.

Abstract:
Tele-rehabilitation refers to the use of information and communication technologies to provide rehabilitation services to people in their homes or other environments. The objective of this paper was to present the development, validation, and usability testing of a low-cost, markerless, full-body tracking virtual reality system designed to provide remote rehabilitation of the upper extremity in patients with stroke. The Methods and Results sections present the progress of our work on system development, system validations, and a feasibility/usability study. We conclude with a brief summary of the initial stages of an intervention study and a discussion of our findings in the context of the next steps. The validation study demonstrated considerable accuracy for some outcomes (i.e., shoulder “pitch” angle, elbow flexion, trunk forward, and side-to-side deviation). In addition, positive responses were received from the clients who participated in the feasibility study. We are currently in the process of improving the accuracy of the system and analyzing results from a randomized clinical trial, which assessed the effectiveness of the system to improve upper extremity function post-stroke.

Tele-rehabilitation service delivery journey from prototype to robust in-home use.

Kizony R, Weiss PL, Harel S, Feldman Y, Obuhov A, Zeilig G, Shani M. Disabil Rehabil. 2017 Jul;39(15):1532-1540.

Abstract:
Purpose: The purpose of this study is to present a retrospective study on clients with Acquired Brain Injury (ABI) enrolled in a tele-motion-rehabilitation service program for two or more months.
Methods: Data from 82 clients (46 males; 74 with ABI), aged 22-85 years, are reported. The Kinect-based CogniMotion System (ReAbility Online, Gertner Institute, Tel Hashomer, Israel) provided services that included 30-min biweekly sessions. Participants were evaluated prior to and 2 months following the commencement of service with clinical assessments that measured movements and function of the weaker upper extremity and cognitive abilities.
Results: Clients enrolled in the service had intact or mild cognitive impairment, mild-moderate motor impairment but little use of their weak upper extremity for daily activities. They were satisfied with the service and reported high levels of system usability. Post-intervention clinical assessments were performed on about half of the participants after 2 months; significant improvements in active movements of the weak upper extremity, shoulder flexion range of motion and in the Trail Making Test were found ($p < 0.05$).
Conclusions: The service appears to be feasible for people with ABI and effective in important clinical outcomes related to improvements in upper extremity function. Implications for Rehabilitation Tele-rehabilitation provided with Microsoft Kinect 3D sensor virtual reality tracking system is feasible for people with Acquired Brain Injury. People with Acquired Brain Injury in the chronic stage were satisfied with the tele-rehabilitation service and perceived it as beneficial to improve their motor and cognitive abilities The CogniMotion System service appears to be effective in important clinical outcomes related to improvements in upper extremity function.

The emotional-behavioral state of Israeli adolescent and young adult females with anorexia nervosa during the COVID19 pandemic.

Serur Y, Dikstein H, Shilton T, Gothelf D, Latzer Y, Lewis Y, Enoch-Levy A, Pessach I, Gur E, Stein D. J Eat Disord. 2022 Oct 8;10(1):145.

Abstract:
Background: During the COVID-19 pandemic in Israel, the number of patients with eating disorders (EDs) seeking treatment increased significantly. The present study sought to evaluate whether, during the pandemic (2020-21), patients with anorexia nervosa (AN) would show more ED-related, comorbid, and COVID-19-related symptoms in comparison to a naturalistic control group, and whether differences would be found between adult and adolescent patients with AN. We also examined attitudes to telemedicine use during the pandemic in patients receiving long-distance interventions.
Methods: Using online self-report questionnaires, we assessed general and COVID-19-specific symptoms with a secure digital platform (REDCap®) in 36 female adolescents with AN, 35 female adults with AN, and 25 female controls.
Results: Compared with controls, patients with AN showed more symptoms of EDs, anxiety, depression, and post-traumatic stress disorder (PTSD), elevated suicidal ideation, more COVID-related emotional-behavioral disturbances, and lower resilience. Adult patients with AN fared worse than adolescent patients on most of these measures. Adult patients using telemedicine during the COVID-19 pandemic showed fewer positive attitudes toward this treatment than adolescents (telemedicine was offered to all, but used by 18/35 adolescents and 21/36 adults with AN). Last, elevated COVID-19-related symptomatology was correlated with more symptoms of ED, anxiety, depression and PTSD, and with lower resilience.
Conclusions: Our findings suggest that the emotional-behavioral state of Israeli females with AN, particularly adults, was worse during the COVID-19 pandemic in comparison to controls. Many patients did not use telemedicine for their treatment. Adult patients using telemedicine were less satisfied with it than adolescent patients.

The effect of a telerehabilitation virtual reality intervention on functional upper limb activities in people with multiple sclerosis: a study protocol for the TEAMS pilot randomized controlled trial.

Kalron A, Achiron A, Pau M, Cocco E. Trials. 2020 Aug 12;21(1):713.

Abstract:
Background: Approximately 60% of people with multiple sclerosis (PwMS) suffer from upper limb dysfunction. Our primary goal is to implement a single-blind, randomized control trial (RCT) designed to compare the effectiveness of an 8-week home-based telerehab virtual reality (VR) program with conventional therapy in PwMS with manual dexterity difficulties. Secondary aims include (a) evaluating the impact of the programs on quality of life after the intervention and a follow-up 1 month later and (b) evaluating the impact of the programs on adherence and satisfaction.
Methods: Twenty-four PwMS will be recruited to the study which will be conducted at two established MS centers: (1) The Regional Center for Diagnosis and Treatment of Multiple Sclerosis, Binaghi Hospital, Cagliari, Italy, and (2) The Multiple Sclerosis Center, Sheba Medical Center, Tel-Hashomer, Israel. Participants will complete a total of three assessments focusing on upper limb functions. Both groups will receive 16 training sessions focusing on functional upper limb activities. The home-based telerehab VR intervention will comprise a custom-made software program running on a private computer or laptop. PwMS will perform several activities of daily living (ADL) functions associated with self-care, dressing, and meal preparation. Conventional therapy will focus on task-related upper-limb treatments while in a sitting position, indicative of the standard care in MS. Following 8 weeks of training, participants will complete a further outcome assessment. The same tests will be conducted 1 month (as a follow-up) after completion of the intervention.
Discussion: The outcomes of this study have tremendous potential to improve the quality of evidence and informed decisions of functional upper limb activities in PwMS. If comparable results are found between the treatments in improving upper limb outcomes, this would suggest that PwMS can choose the program that best meets their personal needs, e.g., financial concerns, transportation, or accessibility issues. Secondly, this information can be used by healthcare providers and medical professionals in developing upper limb exercise programs that will most likely succeed in PwMS.

Testing the Efficacy of a Smartphone Application in Improving Medication Adherence, Among Children with ADHD.

Weisman O, Schonherz Y, Harel T, Efron M, Elazar M, Gothelf D. Isr J Psychiatry. 2018;55(2):59-63.

Abstract:
Background: Adherence to medication is a key factor for successful treatment of children with ADHD. However, most children do not adhere to their pharmacotherapy regimen, and have no contact with their physician during the first month of pharmacotherapy. A mobile health (mHealth) approach may bridge the gap between physicians and patients, allowing for more frequent communications as well as better monitoring of adherence to the prescribed treatment.
Method: The study sample included 39 children with ADHD (27 boys), aged 9.56±2.41 years. Participants were randomly assigned to one of the following two groups: (1) a study group in which participants and their parents were prompted to use a mobile application (i.e., mobile app or app); or to (2) a control group in which participants were treated as usual, without the app. Pill counts, which is a common strategy for confirming medication adherence, was recorded at week 4 and week 8. Clinical assessment conducted at baseline, week 4, and week 8.
Results: Participants who were prescribed with the app demonstrated higher overall pill counts over 8-weeks period, $F=4.33$, $p<.05$. In addition, a significant improvement in total CRS score was found among the study group compared to controls in week 4 and week 8, $F=4.74$, $p<.05$.
Conclusions: The current study provides initial support for the feasibility of a new mobile app in promoting adherence to stimulants among youth with ADHD.

Obesity & Healthy Living

Comparison of a Telehealth-Based Intensive Treatment Program with a Rewarding App vs. On-Site Care for Youth with Obesity: A Historical Cohort Study.

Khen Sela Peremen , Shay Maor , Amit Yaniv , Ishai Aloni , Tomer Ziv-Baran , Gal Dubnov-Raz. Children (Basel). 2023 Jul; 10(7): 1117

Abstract:
The recommended treatment for children with obesity includes numerous consultations by a multidisciplinary team, which is very cumbersome. Telehealth can assist in administering frequent care to children with obesity, yet the exact approaches and modes of delivery are still explored. During the COVID-19 pandemic, we developed an intensive telehealth-based treatment program that included a rewarding app for children with obesity. The aim of this study was to compare 6-month changes in body mass index (BMI) and body fat percent between participants in the program (n = 70) vs. children that underwent historic on-site care (n = 87). After 6 months, more participants in the telehealth group continued treatment compared to the on-site group (79% vs. 60%, $p < 0.001$). A significant reduction in the median BMI z-score (zBMI) was seen after 6 months in both groups ($p < 0.01$), with a similar proportion of zBMI reductions (71% in the telehealth group, 75% in the comparison group, p = 0.76). No statistically significant differences were found between the study groups in 6-month changes in BMI, zBMI, body fat percent or fat z-scores. We conclude that our telehealth program, which was executed during the COVID-19 pandemic, resulted in a high proportion of children with zBMI reduction that was comparable with the more personal on-site care.

Managing Obesity in Lockdown: Survey of Health Behaviors and Telemedicine.

Minsky NC, Pachter D, Zacay G, Chishlevitz N, Ben-Hamo M, Weiner D, Segal-Lieberman G. Nutrients. 2021 Apr 19;13(4):1359.

Abstract:
Since the outbreak of COVID-19, billions of people have gone into lockdown, facing pandemic related challenges that engender weight gain, especially in the obese. We report the results of an online survey, conducted during Israel's first quarantine, of 279 adults treated in hospital-based obesity clinics with counseling, medications, surgery, endoscopic procedures, or any combination of these for weight loss. In this study, we assessed the association between changes in dietary and lifestyle habits and body weight, and the benefits of receiving weight management care remotely through telemedicine during lockdown. Compared to patients not receiving obesity care via telemedicine, patients receiving this care were more likely to lose weight (OR, 2.79; $p = 0.042$) and also to increase participation in exercise (OR, 2.4; $p = 0.022$). While 40% of respondents reported consuming more sweet or salty processed snacks and 33% reported less vegetables and fruits, 65% reported more homemade foods. At the same time, 40% of respondents reported a reduction in exercise and 52% reported a decline in mood. Alterations in these eating patterns, as well as in exercise habits and mood, were significantly associated with weight changes. This study highlights that lockdown affects health behaviors associated with weight change, and advocates for the use of telemedicine to provide ongoing obesity care during future quarantines in order to promote weight loss and prevent weight gain.

Cardiology & Cardiac Tele-rehabilitation

Evaluating the Effects of an Enhanced Strength Training Program in Remote Cardiological Rehabilitation: A Shift from Aerobic Dominance-A Pilot Randomized Controlled Trial

Nabutovsky I, Sabah R, Moreno M, Epstein Y, Klempfner R, Scheinowitz M.J
Clin Med. 2024 Mar 1;13(5):1445.

Abstract:
Background: Cardiac rehabilitation often emphasizes aerobic capacity while overlooking the importance of muscle strength. This study evaluated the impact of an enhanced remote strength training program (RCR-ST) on cardiac rehabilitation.
Methods: In this randomized prospective study (RCT registration number SMC-9080-22), 50 patients starting cardiac rehabilitation were assessed for muscle strength, aerobic capacity, and self-reported outcomes at baseline and after 16 weeks. Participants were divided into two groups: the RCR-ST group received a targeted resistance training program via a mobile app and smartwatch, while the control group received standard care with general resistance training advice.
Results: The RCR-ST group demonstrated significant improvements in muscle endurance, notably in leg extension and chest press exercises, with increases of 92% compared to 25% and 92% compared to 13% in the control group, respectively. Functional assessments (5-STS and TUG tests) also showed marked improvements in agility, coordination, and balance. Both groups improved in cardiorespiratory fitness, similarly. The RCR-ST group reported enhanced physical health and showed increased engagement, as evidenced by more frequent use of the mobile app and longer participation in the rehabilitation program ($p < 0.05$).
Conclusions: Incorporating a focused strength training regimen in remote cardiac rehabilitation significantly improves muscle endurance and patient engagement. The RCR-ST program presents a promising approach for optimizing patient outcomes by addressing a crucial gap in traditional rehabilitation protocols that primarily focus on aerobic training.

Home-Based Cardiac Rehabilitation Among Patients Unwilling to Participate in Hospital-Based Programs.

Nabutovsky I, Breitner D, Heller A, Levine Y, Moreno M, Scheinowitz M, Levin C, Klempfner R. J Cardiopulm Rehabil Prev. 2024 Jan 1;44(1):33-39.

Abstract:

Purpose: Asynchronous home-based cardiac rehabilitation (HBCR) is a viable alternative to center-based cardiac rehabilitation (CBCR). However, to achieve significant functional improvement, a high level of adherence and activity must be achieved. The effectiveness of HBCR among patients who actively avoid CBCR has not been effectively investigated. This study aimed to investigate the effectiveness of the HBCR program among patients unwilling to participate in CBCR.

Methods: A randomized prospective study enrolled 45 participants to a 6-mo HBCR program and the remaining 24 were allocated to regular care. Both groups were digitally monitored for physical activity (PA) and self-reported outcomes. Change in peak oxygen uptake (V□O 2peak), the primary study outcome, was measured by the cardiopulmonary exercise test, immediately before program start and 4 mo thereafter.

Results: The study included 69 patients, 81% men, aged 55.9 ±12 yr, enrolled in a 6-mo HBCR program to follow a myocardial infarction (25.4%) or coronary interventions (41.3%), heart failure hospitalization (29%), or heart transplantation (10%). Weekly aerobic exercise totaled a median of 193.2 (110.2-251.5) min (129% of set exercise goal), of which 112 (70-150) min was in the heart rate zone recommended by the exercise physiologist.After 4 mo, V□O 2peak improved by 10.2% in the intervention group versus -2.7% in the control group (+2.46 ± 2.67 vs -0.72 ± 3.02 mL/kg/min; P < .001).

Conclusion: The monthly PA of patients in the HBCR versus conventional CBCR group were well within guideline recommendations, showing a significant improvement in cardiorespiratory fitness. Risk level, age, and lack of motivation at the beginning of the program did not prevent achieving goals and maintaining adherence.

Advances in Technology Promote Patient-Centered Care in Cardiac Rehabilitation.

Ben-Tzur D, Sabovich S, Hutzler Y, Rimon J, Zach S, Epstein M, Vadasz B, Diniz CV, Nabutovsky I, Klempfner R, Eilat-Adar S, Gabizon I, Menachemi DM, Grosman-Rimon L. Cardiol Rev. 2023 Aug 21.

Abstract:
Patient-centered health care (PCC) is a framework of clinical care focused on the patient's individual health care needs. In particular, it emphasizes the development of a partnership between the patient, physician, and healthcare workers to actively involve and empower the patient in their health care decisions. Additionally, PCC goals include ensuring access to care, emotional support, engaging patient support systems, physical comfort, and continuity of care. Technology also provides a platform to engage patients and their families in their care and can be a useful tool to gauge their level of interest, knowledge, and motivations to adequately educate them on the many factors that contribute to their disease, including diet, exercise, medication adherence, psychological support, and early symptom detection. In this article, we summarize the importance of technology in promoting PCC in cardiac rehabilitation and the impact technology may have on the different aspects of patient and physician relationships. Modern technological devices including smartphones, tablets, wearables, and other internet-enabled devices have been shown to help patient-staff communication, cater to patients' individual needs, increase access to health care, and implement aspects of PCC domains.

Israel's first national remote cardiac rehabilitation program: A retrospective analysis.

Nabutovsky I, Breitner D, Heller A, Moreno M, Levine Y, Klempfner Y, Scheinowitz M, Klempfner R. Digit Health. 2023 Jun 26;9:20552076231180762

Abstract:
Aims: Cardiac rehabilitation is an essential component of secondary prevention consistently unexploited by most eligible patients. Accordingly, the remote cardiac rehabilitation program (RCRP) was developed to create optimal conditions for remote instruction and supervision for patients to enable successful completion of the program.
Methods: This study comprised 306 patients with established coronary heart disease who underwent a 6-month RCRP. RCRP involves regular exercise, monitored by a smartwatch that relays data to the operations center and a mobile application on the patient's smartphone. A stress test was performed immediately before the RCRP and repeated after 3 months. The aims were to determine the effectiveness of the RCRP in improving aerobic capacity, and correlating the program goals and first-month activity, with attaining program goals during the last month.
Results: Participants were mostly male (81.5%), aged 58 ± 11, enrolled in the main after a myocardial infarction or coronary interventions. Patients exercised aerobically for 183 min each week, 101 min (55% of total exercise) at the target heart rate. There was a significant improvement in exercise capacity, assessed by stress tests, metabolic equivalents which increased from 9.5 ± 3 to 11.4 ± 7($p < 0.001$). Independent predictors of RCRP goals were older age and more minutes of aerobic exercise during the first program month ($p < 0.05$).
Conclusion: Participants succeeded in performing guideline recommendations, resulting in a significant improvement in exercise capacity. Older age and increased volume of first month of exercise were significant factors associated with a greater likelihood to attain program goals.

Blood lipid levels and treatment following an acute coronary syndrome or coronary intervention - Journey from hospital to cardiac rehabilitation.

Rott D, Hay I, Nabutovsky I, Heller A, Breitner D, Klempfner R.
Int J Cardiol Cardiovasc Risk Prev. 2022 Aug 17;15:200145

Abstract:
Background: A significant number of coronary artery disease patients do not attain guideline recommended LDL levels. Participating in a cardiac rehabilitation (CR) program has been shown to improve adherence to medical therapy.
Objectives: Evaluate the specific lipid lowering therapy (LLT) prescribed and percent of subjects achieving LDL levels of <70 mg/dL before and after 3 months following CR program initiation.
Methods: From May 2017 to April 2019, we prospectively recruited patients referred to our CR program and compared 1015 of them at 4 time points; (P1) just prior to the index hospitalization, (P2) during the index hospitalization, (P3) upon entering the CR program, roughly 3 months after the index hospitalization, and (P4) 3 months into the CR program. Included in the analysis were parameters of lipid levels, the dispensed medication given, as well as patient adherence to treatment.
Results: At CR intake, LDL goals were partially achieved with 57% of patients below 70 mg/dL. After completion of 3 months of CR, 63% of patients had LDL levels below 70 mg/dL, despite the fact that the majority (95%) were prescribed high-dose potent statins. Aside from the LDL levels at CR intake, we found no other independent predictors for not attaining the lipid goals at 6 months.
Conclusions: A significant treatment gap is present even in a selected population participating in CR, with the vast majority receiving guideline recommended LLT. In order to improve goals, we need to intensify LLT treatment, and increase patient adherence to therapy.

The First National Program of Remote Cardiac Rehabilitation in Israel-Goal Achievements, Adherence, and Responsiveness in Older Adult Patients: Retrospective Analysis.

Nabutovsky I, Breitner D, Heller A, Scheinowitz M, Klempfner Y, Klempfner R.JMIR Cardio. 2022 Nov 16;6(2):e36947.

Abstract:
Background: Remote cardiac rehabilitation (RCR) after myocardial infarction is an innovative Israeli national program in the field of telecardiology. RCR is included in the Israeli health coverage for all citizens. It is generally accepted that telemedicine programs better apply to younger patients because it is thought that they are more technologically literate than are older patients. It has also previously been thought that older patients have difficulty using technology-based programs and attaining program goals.
Objective: The objectives of this study were as follows: to study patterns of physical activity, goal achievement, and improvement in functional capacity among patients undergoing RCR over 65 years old compared to those of younger patients; and to identify predictors of better adherence with the RCR program.
Methods: A retrospective study of patients post-myocardial infarction were enrolled in a 6-month RCR program. The activity of the patients was monitored using a smartwatch. The data were collected and analyzed by a special telemedicine platform. RCR program goals were as follows: 150 minutes of aerobic activity per week, 120 minutes of the activity in the target heart rate recommended by the exercise physiologist, and 8000 steps per day. Models were created to evaluate variables predicting adherence with the program.
Results: Out of 306 patients, 80 were older adults (mean age 70 years, SD 3.4 years). At the end of the program, there was a significant improvement in the functional capacity of all patients (P=.002). Specifically, the older adult group improved from a mean 8.1 (SD 2.8) to 11.2 (SD 12.6). The metabolic equivalents of task (METs) and final MET results were similar among older and younger patients. During the entire program period, the older adult group showed better achievement of program goals compared to younger patients (P=.03). Additionally, we found that younger patient age is an independent predictor of early dropout from the program and completion of program goals (P=.045); younger patients were more likely to experience early program dropout and to complete fewer program goals.
Conclusions: Older adult patients demonstrated better compliance and achievement of the goals of the remote rehabilitation program in comparison with younger patients. We found that older age is not a limitation but rather a predictor of better RCR program compliance and program goal achievement.

Improving cardiac rehabilitation patient adherence via personalized interventions.

Aharon KB, Gershfeld-Litvin A, Amir O, Nabutovsky I, Klempfner R.
PLoS One. 2022 Aug 29;17(8):e0273815

Abstract:
Objectives: Despite documented benefits and physicians' recommendations to participate in cardiac rehabilitation (CR) programs, the average dropout rate remains between 12-56%. This study's goal was to demonstrate that using personalized interventions can significantly increase patient adherence.
Method: Ninety-five patients (ages 18-90) eligible for the CR program were randomly recruited and received personalized interventions using the Well-Beat system. Adherence levels were compared to those of a historical control group. The Well-Beat system provided Sheba CR Health Care Provider (HCP) guidelines for personalized patient-therapist dialogue. The system also generated ongoing personalized text messages for each patient sent twice a week and related each patient's dynamic profile to their daily behavior, creating continuity, and reinforcing the desired behavior.
Results: A significant increase in patient adherence to the CR program: Three months after initiation, 76% remained active compared to the historical average of 24% in the matched control group (log-rank p-value = 0.001).
Conclusions: Using an Artificial Intelligence (AI)-based engine that generated recommendations and messages made it possible to improve patient adherence without increasing HCP load, benefiting all. Presenting customized patient insights to the HCP and generating personalized communications along with action motivating text messages can also be useful for remote care.

Vocal Biomarker Is Associated With Hospitalization and Mortality Among Heart Failure Patients.

Maor E, Perry D, Mevorach D, Taiblum N, Luz Y, Mazin I, Lerman A, Koren G, Shalev V. J Am Heart Assoc. 2020 Apr 7;9(7):e013359.

Abstract:
Background: The purpose of this article is to evaluate the association of voice signal analysis with adverse outcome among patients with congestive heart failure (CHF).
Methods and Results: The study cohort included 10 583 patients who were registered to a call center of patients who had chronic conditions including CHF in Israel between 2013 and 2018. A total of 223 acoustic features were extracted from 20 s of speech for each patient. A biomarker was developed based on a training cohort of non-CHF patients (N=8316). The biomarker was tested on a mutually exclusive CHF study cohort (N=2267) and was evaluated as a continuous and ordinal (4 quartiles) variable. Median age of the CHF study population was 77 (interquartile range 68-83) and 63% were men. During a median follow-up of 20 months (interquartile range 9-34), 824 (36%) patients died. Kaplan-Meier survival analysis showed higher cumulative probability of death with increasing quartiles (23%, 29%, 38%, and 54%; $P<0.001$). Survival analysis with adjustment to known predictors of poor survival demonstrated that each SD increase in the biomarker was associated with a significant 32% increased risk of death during follow-up (95% CI, 1.24-1.41, $P<0.001$) and that compared with the lowest quartile, patients in the highest quartile were 96% more likely to die (95% CI, 1.59-2.42, $P<0.001$). The model consistently demonstrated an independent association of the biomarker with hospitalizations during follow-up ($P<0.001$).
Conclusions: Noninvasive vocal biomarker is associated with adverse outcome among CHF patients, suggesting a possible role for voice analysis in telemedicine and CHF patient care.

Adherence to Remote Cardiac Rehabilitation During the Coronavirus Pandemic: A Retrospective Cohort Analysis.

Nabutovsky I, Breitner D, Heller A, Klempfner Y, Klempfner R.
J Cardiopulm Rehabil Prev. 2021 Mar 1;41(2):127-129.

No abstract available - Research Letters

From 'Remote Cardiac Rehabilitation' To Chronic Disease Managements Programs By Digital Means – Review Of The National Program As A Model For Multi-Disciplinary Disease Management.

Nabutovsky I, Tesler R, Gang Kregenbild N, Nachshon A, Yeshayahu S, Klempfner R, Shapiro Y.Harefuah. 2020 Jun;159(6):398-405. Review. Hebrew.

Abstract:
Cardiovascular diseases, often accompanied by many background diseases, are the main cause of morbidity and mortality globally. Cardiac rehabilitation programs are a key component of secondary prevention and lack of participation or adherence lead to significantly higher adverse event rates including hospitalization and mortality. Technological means have great potential for improving health care outcomes. Home-cardiac rehabilitation (H-CR) using technology implements the 'patient-centered' approach within the health services. Last year, the Israeli Ministry of Health approved the H-CR program for a low-risk patient and included it into medical coverage of the state. In accordance with the Ministry of Health circular, the H-CR program is implemented at the Sheba Medical Center since November 2018. The program incorporates innovative technology alongside multi-professional care. Implementation of the program enables studies about the methods to put into effect the therapeutic model in other chronic disease management, including home rehabilitation or hospitalization programs, while maintaining patient safety and securing medical information. The purpose of this article is to review the first H-CR program in Israel, its components, benefits, and challenges, as well as, to present the therapeutic model, its competence in multidisciplinary disease management and increased responsiveness to the treatment.

Feasibility, Safety, and Effectiveness of a Mobile Application in Cardiac Rehabilitation.

Nabutovsky I, Ashri S, Nachshon A, Tesler R, Shapiro Y, Wright E, Vadasz B, Offer A, Grosman-Rimon L, Klempfner R.Isr Med Assoc J. 2020 Jun;22(6):357-363.

Abstract:
Background: Cardiac rehabilitation (CR) is underutilized globally despite evidence of clinical benefit. Major obstacles for wider adoption include distance from the rehabilitation center, travel time, and interference with daily routine. Tele-cardiac rehabilitation (tele-CR) can potentially address some of these limitations, enabling patients to exercise in their home environment or community.
Objectives: To evaluate the clinical and physiological outcomes as well as adherence to tele-CR in patients with low cardiovascular risk and to assess exercise capacity, determined by an exercise stress test, using a treadmill before and following the 6-month intervention.
Methods: A total of 22 patients with established coronary artery disease participated in a 6-month tele-CR program. Datos Health (Ramat Gan, Israel), a digital health application and care-team dashboard, was used for remote monitoring, communication, and management of the patients.
Results: Following the 6-month tele-CR intervention, there was significant improvement in exercise capacity, assessed by estimated metabolic equivalents with an increase from 10.6 ± 0.5 to 12.3 ± 0.5 (P = 0.002). High-density lipoproteins levels significantly improved, whereas low-density lipoproteins, triglyceride, glycosylated hemoglobin, and systolic and diastolic blood pressure levels were not significantly changed. Exercise adherence was consistent among patients, with more than 63% of patients participating in a moderate intensity exercise program for 150 minutes per week.
Conclusions: Patients who participated in tele-CR adhered to the exercise program and attained clinically significant functional improvement. Tele-CR is a viable option for populations that cannot, or elect not to, participate in center-based CR programs.

Digital Cardiac Rehabilitation Programs: The Future of Patient-Centered Medicine.

Nabutovsky I, Nachshon A, Klempfner R, Shapiro Y, Tesler R.Telemed J E Health. 2020 Jan;26(1):34-41. doi: 10.1089/tmj.2018.0302. Epub 2019 Sep 5.

Abstract:
Background: The low participation rate in cardiac rehabilitation programs is the major reason for rehospitalization, morbidity, and mortality. Home-based cardiac rehabilitation by technological means is an essential component of a "patient-centered" approach, which is capable of enhancing the participation rate in rehabilitation programs.
Introduction: The aim of this research was to examine attitudes, perceptions, and behavioral intentions toward remote digital cardiac rehabilitation (RDCR) with respect to factors such as age, education, smoking, exercise habits, technological illiteracy, and mobile phone behavior.
Materials and Methods: This was a cross-sectional study of 200 adult patients discharged from a hospital after an acute coronary syndrome, cardiac surgery, or percutaneous coronary intervention. All patients answered an anonymous Technology Usage Questionnaire, which examined the relationship between their willingness to participate in the RDCR program and various parameters. The surveys were distributed and completed between July 2017 and November 2017 at the Sheba Medical Center in Israel.
Results: Overall, 83% of all participants were interested in participating in the RDCR program. Those with heart failure had a greater interest in the program (100%; $p < 0.05$), whereas patients after coronary bypass surgery had a lesser interest (71.1%; $p < 0.05$). The level of attitude toward healthy lifestyle was found to be a significant predictor of willingness to participate in RDCR (odds ratio 2.26; $p = 0.01$). Sociodemographic characteristics, lifestyle, habits, technological knowledge, age, and gender were not found as significant predictors of interest in RDCR.
Conclusions: The RDCR program was acceptable to most cardiac patients, including the elderly population, and could be a potential solution for patients who avoid traditional rehabilitation programs in medical centers.

Remote Diabetes Monitoring

Glycemic outcomes and patient satisfaction and self-management improves in transition from standard to virtual multidisciplinary care.

Minsky N, Arnon Klug L, Kolobov T, Tarshish E, Shalev Many Y, Lipsitz A, Jabarin A, Morozov N, Halperin D, Shalom M, Nissanholtz-Gannot R, Aharon-Hananel G, Tirosh A, Tamir O. Diabetes Res Clin Pract. 2024 Mar;209:111587.

Abstract:
Aims: With advances in cloud-based technologies, there has been a rise in remote T1D care. We hypothesized that transitioning T1DM care to a virtual, multidisciplinary clinic could improve measures beyond HbA1c.
Methods: To assess the impact of transitioning from standard to virtual T1DM care, we evaluated glycemic measures and patient reported outcomes.
Results: Sixty-one adults with T1DM were included, with mean age 40.2 ± 13.5 years and diabetes duration 16.9 ± 9.0 years. Most patients were treated with insulin pumps and CGM. The number of annual diabetes care encounters rose from 2.1 ± 4.2 to 12.8 ± 5.5. Baseline HbA1c was 7.9 ± 1.6 %(63 ± 16.9 mmol/mol), declining to 7.3 ± 1.1 %(56 ± 8.5 mmol/mol) and 7.1 ± 1.0 %(54 ± 7.7 mmol/mol) at 6 and 12 months respectively ($p < 0.001$ for both). In parallel, TIR improved from 63.1 ± 19.3 % to 69.2 ± 13.8 % ($p < 0.001$) and 67.5 ± 19.4 % ($p = 0.03$) at 6 and 12 months respectively, while TBR declined. Scores from validated diabetes treatment and self-management questionnaires rose significantly and these rises were associated with a reduction in HbA1c, the latter score was also associated with increased TIR. There was a trend toward a correlation between encounter frequency and improvement in HbA1c and TIR.
Conclusions: Transitioning from standard to virtual, coordinated, multidisciplinary T1DM care is associated with increased visit frequency, improving glycemic control, treatment satisfaction and self-care behaviors

Gastroenterology

Innovation in Gastroenterology-Can We Do Better?

Eyal Klang , Shelly Soffer , Abraham Tsur , Eyal Shachar , Adi Lahat Biomimetics (Basel) 2022 Mar 19;7(1):33

Abstract:
The health system can reap significant benefits by adopting and implementing innovative measures, as was recently demonstrated and emphasized during the COVID-19 pandemic. Herein, we present our bird's eye view of gastroenterology's innovative technologies via utilizing a text-mining technique. We analyzed five research fields that comply with innovation: artificial intelligence (AI), virtual reality (VR), telemedicine, the microbiome, and advanced endoscopy. According to gastroenterology literature, the two most innovative fields were the microbiome and advanced endoscopy. Though artificial intelligence (AI), virtual reality (VR), and telemedicine trailed behind, the number of AI publications in gastroenterology has shown an exponential trend in the last couple of years. While VR and telemedicine are neglected compared to other fields, their implementation could improve physician and patient training, patient access to care, cost reduction, and patient outcomes.

Telemedicine in clinical gastroenterology practice: what do patients prefer?

Lahat A, Shatz Z. Therap Adv Gastroenterol. 2021 Feb 11;14:1756284821989178

Abstract:
Background: The Coronavirus Disease 2019 pandemic has forced major changes on healthcare systems. Maintaining regular patients' surveillance became a major challenge. Telemedicine has been promoted as an economic and effective way for long distance patient care. Our aim was to study patients' acceptance and perspectives on telemedicine.
Methods: Patients scheduled for clinic appointments were offered telemedicine. Those who agreed were asked to fill in a questionnaire assessing their satisfaction with the medical consultation. Patients' demographic characteristics and answers were collected and reviewed.
Results: Out of 358 patients approached 71 agreed to use telemedicine. Of them, 59 completed the questionnaire and were included in the study. All patients' basic demographic data were collected. Patients' included in the study mean age was: 43 ± 16.3 years, 35 (59.3%) women. Patients who chose not to use telemedicine were significantly older, mean age: 61 ± 15.2 years (p = 0.036), 134 (46.7%) women. Most patients included (38; 64.4%) had inflammatory bowel disease (IBD). Most patients who chose not to use telemedicine were non-IBD patients (206, 72%). Fifty-one patients (86.4%) assessed their experience as 'good' or 'excellent'. Satisfied patients had significantly less time under medical follow-up (3.7 *versus* 6.1 years, p = 0.028) and tended to be younger (p = non-significant). Women were statistically significantly more satisfied than men (33 *versus* 18, p = 0.05). Advantages reported were 'time saving' (31.3%), accessibility (26.1%), availability (25%). The main disadvantage was absence of physical examination (70%).
Conclusions: Telemedicine gained a high satisfaction rate among patients under regular medical surveillance. Most patients stated this that method is convenient, time saving and increases their compliance. Patients who agreed to telecare were younger, and tended to be of female gender and experiencing IBD. Further studies are needed to characterize specific barriers to telecare usage.

COVID 19:

Establishing a COVID-19 treatment centre in Israel at the initial stage of the outbreak: challenges, responses and lessons learned

Bar-On E, Segal G, Regev-Yochay G, Barkai G, Biber A, Irony A, Luttinger A, Englard H, Grinberg A, Katorza E, Rahav G, Afek A, Kreiss Y.. Emerg Med J. 2021 May;38(5):373-378.

Abstract:
Anticipating the need for a COVID-19 treatment centre in Israel, a designated facility was established at Sheba Medical Center-a quaternary referral centre. The goals were diagnosis and treatment of patients with COVID-19 while protecting patients and staff from infection and ensuring operational continuity and treatment of patients with non-COVID. Options considered included adaptation of existing wards, building a tented facility and converting a non-medical structure. The option chosen was a non-medical structure converted to a hospitalisation facility suited for COVID-19 with appropriate logistic and organisational adaptations. Operational principles included patient isolation, unidirectional workflow from clean to contaminated zones and minimising direct contact between patients and caregivers using personal protection equipment (PPE) and a multimodal telemedicine system. The ED was modified to enable triage and treatment of patients with COVID-19 while maintaining a COVID-19-free environment in the main campus. This system enabled treatment of patients with COVID-19 while maintaining staff safety and conserving the operational continuity and the ability to continue delivery of treatment to patients with non-COVID-19.

Inpatient Telemedicine and New Models of Care during COVID-19: Hospital Design Strategies to Enhance Patient and Staff Safety.

Pilosof NP, Barrett M, Oborn E, Barkai G, Pessach IM, Zimlichman E.Int J Environ Res Public Health. 2021 Aug 8;18(16):8391

Abstract:
The challenges of the COVID-19 pandemic have led to the development of new hospital design strategies and models of care. To enhance staff safety while preserving patient safety and quality of care, hospitals have created a new model of remote inpatient care using telemedicine technologies. The design of the COVID-19 units divided the space into contaminated and clean zones and integrated a control room with audio-visual technologies to remotely supervise, communicate, and support the care being provided in the contaminated zone. The research is based on semi-structured interviews and observations of care processes that implemented a new model of inpatient telemedicine at Sheba Medical Center in Israel in different COVID-19 units, including an intensive care unit (ICU) and internal medicine unit (IMU). The study examines the impact of the diverse design layouts of the different units associated with the implementation of digital technologies for remote care on patient and staff safety. The results demonstrate the challenges and opportunities of integrating inpatient telemedicine for critical and intermediate care to enhance patient and staff safety. We contribute insights into the design of hospital units to support new models of remote care and suggest implications for Evidence-based Design (EBD), which will guide much needed future research.

Patient and clinician experience with a rapidly implemented large-scale video consultation program during COVID-19.

Barkai G, Gadot M, Amir H, Menashe M, Shvimer-Rothschild L, Zimlichman E.. Int J Qual Health Care. 2021 Feb 20;33(1):mzaa165.

Abstract:
Background: The coronavirus disease 2019 (COVID-19) pandemic has forced health-care providers to find creative ways to allow continuity of care in times of lockdown. Telemedicine enables provision of care when in-person visits are not possible. Sheba Medical Center made a rapid transition of outpatient clinics to video consultations (VC) during the first wave of COVID-19 in Israel.
Objective: Results of a survey of patient and clinician user experience with VC are reported.
Methods: Satisfaction surveys were sent by text messages to patients, clinicians who practice VC (users) and clinicians who do not practice VC (non-users). Questions referred to general satisfaction, ease of use, technical issues and medical and communication quality. Questions and scales were based on surveys used regularly in outpatient clinics of Sheba Medical Center.
Results: More than 1200 clinicians (physicians, psychologists, nurses, social workers, dietitians, speech therapists, genetic consultants and others) provided VC during the study period. Five hundred and forty patients, 162 clinicians who were users and 50 clinicians who were non-users completed the survey. High level of satisfaction was reported by 89.8% of patients and 37.7% of clinician users. Technical problems were experienced by 21% of patients and 80% of clinician users. Almost 70% of patients but only 23.5% of clinicians found the platform very simple to use. Over 90% of patients were very satisfied with clinician's courtesy, expressed a high sense of trust, thought that clinician's explanations and recommendations were clear and estimated that the clinician understood their problems and 86.5% of them would recommend VC to family and friends. Eighty-seven percent of clinician users recognize the benefit of VC for patients during the COVID-19 pandemic but only 68% supported continuation of the service after the pandemic.
Conclusion: Our study reports high levels of patient satisfaction from outpatient clinics VC during the COVID-19 pandemic. Lower levels of clinician satisfaction can mostly be attributed to technical and administrative challenges related to the newly implemented telemedicine platform. Our findings support the continued future use of VC as a means of providing patient-centered care. Future steps need to be taken to continuously improve the clinical and administrative application of telemedicine services.

Transition to Multidisciplinary Pediatric Telerehabilitation during the COVID-19 Pandemic: Strategy Development and Implementation.

Krasovsky T, Silberg T, Barak S, Eisenstein E, Erez N, Feldman I, Guttman D, Liber P, Patael SZ, Sarna H, Sadeh Y, Steinberg P, Landa J.. Int J Environ Res Public Health. 2021 Feb 4;18(4):1484.

Abstract:
Telerehabilitation offers a unique solution for continuity of care in pediatric rehabilitation under physical distancing. The major aims of this study were to: (1) describe the development of telerehabilitation usage guidelines in a large hospital in Israel, and to (2) evaluate the implementation of telerehabilitation from the perspectives of healthcare practitioners and families. An expert focus group developed guidelines which were disseminated to multidisciplinary clinicians. Following sessions, clinicians filled The Clinician Evaluation of Telerehabilitation Service (CETS), a custom-built feedback questionnaire on telerehabilitation, and parents completed the client version of the Therapist Presence Inventory (TPI-C) and were asked to rate the effectiveness of sessions on an ordinal scale. Four goals of telerehabilitation sessions were defined: (1) maintenance of therapeutic alliance, (2) provision of parental coping strategies, (3) assistance in maintaining routine, and (4) preventing functional deterioration. Principal Components Analysis was used for the CETS questionnaire and the relationships of CETS and TPI-C with child's age and the type of session were evaluated using Spearman's correlations and the Kruskal-Wallis H test. In total, sixty-seven telerehabilitation sessions, with clients aged 11.31 ± 4.8 years, were documented by clinicians. Three components (child, session, parent) explained 71.3% of the variance in CETS. According to therapists, their ability to maintain the therapeutic alliance was generally higher than their ability to achieve other predefined goals ($p < 0.01$). With younger children, the ability to provide feedback to the child, grade treatment difficulty and provide coping strategies to the parents were diminished. Families perceived the therapist as being highly present in therapy regardless of treatment type. These results demonstrate a potential framework for the dissemination of telerehabilitation services in pediatric rehabilitation.

Section 2: Posters Presented in Scientific Conferences

Remote High-Risk Pregnancy Monitoring

Putting the “f”etus back in maternal-fetal telemedicine: a prospective pilot study.

Michal Axelrod, Hila Lahav Ezra, Ester Galler, Omer Nir, Galia Barkai, Keren Ofir, Eyal Sivan, Shalev Mazaki Tovi, Abraham Tsur. American Journal of Obstetrics & Gynecology, 2023, Volume 228, Issue 1, S544

Abstract:
Objective: Hybrid care programs bring advantages of virtual visits (cost, logistics and comfort) and in-person visits (doctor-patient relationship and extended clinical evaluation). For maternal-fetal telemedicine to become a mainstream of MFM, the virtual visits must be comprehensive, and extend beyond maternal assessment to fetal wellbeing. We sought to assess the feasibility of hybrid care for women with gestational diabetes mellitus (GDM).
Study Design: A prospective pilot clinical study. Women with a singleton pregnancy and GDM at ≥31 weeks of gestation were recruited. Patient journey included alternating in-person and remote visits for a duration of four weeks. The remote visit included maternal assessment - vital signs, glycemic control (documented in Datos app), urinalysis (Healthy.io), fetal heart rate assessment (INVU by Nuvo™) and ultrasound measured maximal vertical pocket (PulseNmore) yielding a modified biophysical profile (mBPP). Total visit length was compared between the virtual and in-person visits. Usefulness, effectiveness, reliability, and patient satisfaction were assessed with the telehealth usability questionnaire (TUQ).
Results: 20 participants with GDM between 31-34 gestational weeks at recruitment were enrolled. One participant withdrew consent after one virtual visit. 38/39 (97.4%) of remote visits concluded in comprehensive assessment including mBPP to the physician's satisfaction. One referral to in-person monitoring occurred due to technical difficulties. Total remote visit length was significantly shorter (65.4±21.6 min) compared to the in-person visit (171.1±21.4 min, P< 0.001). TUQ results indicate high usability of the telehealth system (6.6/7). No adverse events or safety incidents occurred.
Conclusion: A hybrid maternal-fetal program consisting of alternating in-person and virtual visits is feasible, saves time and improves women satisfaction. Use of the service and technologies requires a learning process for both the care team and the women. Shifting maternal-fetal surveillance to women’s home or work has broad implications with many advantages.

Psychiatry

Mental and emotional preparation for childbirth and parenthood – a parental webinar for the general population.

Maya Sheffer, MD, Vered Bar MD., The International Marcé Society for Perinatal Mental Health, 2022

Abstract:
Background: Childbirth and the transition to parenthood are life changing experiences accompanied by psychosocial challenges and an increased susceptibility to mental health morbidity, Most prenatal courses deal with the obstetric aspects of childbirth and physical care of the newborn, without addressing the psychological impact of the transition to parenthood on the parents themselves, who **often feel underprepared**. Most prevention programs for PPD address high risk population and require physical attendance for a series of appointments. No primary prevention programs were ever published for PP-PTSD.
Methods: We developed a 1 hour long live online psychoeducational interactive course (webinar), given by two reproductive psychiatrists, to women from the general population nearing the end of pregnancy alongside their partners/main caregivers. The webinar is given every 2 months for the past 2 years, as one of the Sheba Medical Center free of charge prenatal courses. High risk population (Women in our clinic with mental health conditions during pregnancy) are invited to join the webinar as well, while also offered a meeting with a midwife and an individualized preparation session with the treating psychiatrist.
Advantages: Virtual format allows participation from all over the country Very low costs of production. Designed for couples – addresses also father's adjustment and mental health. Content is being recorded and available anytime
Just one meeting – improves compliance. Reduces the stigma, may diminish barriers for future contact with mental health services. Received with great feedback from attendees and from colleagues in the perinatal field saying it's "A MUST".

"Going through it together": A website dedicated to identify and helping women at risk for perinatal mood and anxiety disorders (PMAD).

Vered Bar, Galit Neufeld-Kroszynski, Inbal Reuveni, Samira Alfayumi-Zeadna, Karen Yirmiya, Hani Saar, Limor Levi Ossmy, Gil Agar, Kamil Fickler dreszmann, Rena Bina. The International Marcé Society for Perinatal Mental Health, 2022

Abstract:
As a result of COVID-19 and lockdown, perinatal woman in Israel were not able to keep their pregnancy follow-up and "well baby" appointments – where they are evaluated for Perinatal Mood and Anxiety Disorders (PMAD). Identifying and assisting women at risk of PMAD became challenging. A group of stakeholders in Israel has launched a website that provides woman in perinatal period with an online PMAD screening procedure (using the Edinburgh Postnatal Depression Scale: EPDS) and information about symptoms, prevention methods, and resources for help and treatment. Between April 2000-October 2021, 5000 women visited the website, and 2170 completed the screening procedure. Of them, 75% scored ten points or above on EPDS, indicating that they were at risk for PMAD, with 38% at risk for suicide. Moreover, 39% of women who completed the PMAD screening procedure did so during the day, 42% at night, and 18% between midnight and morning. Only 65% of these women stated that they were offered the screening procedure during their prenatal or postpartum visits. The website demonstrated hoe the internet can be used to identify women at risk for PMAD and provide them with valuable information, at their own convenience, which hopefully may increase the number of women who get needed help. Further research is needed to assess the added value of digital PMAD screening.

Neurology & Neurological Tele-rehabilitation

Evaluation of a Tele-Health System for Upper Extremity Stroke Rehabilitation.

R Kizony, P L Weiss, O Elion, S Harel, I Baum-Cohen, Y Feldman, M Shani
International Conference Virtual Rehabilitation (ICVR), USA, Aug. 26-29, 2013

Abstract:
The goal was to evaluate the clinical effectiveness of a quasi-home-based tele-motion-rehabilitation (TMR) program, using the Gertner System, in improving functional ability of the weak upper extremity post-stroke. Eighteen adults with stroke were randomized into two groups; a quasi-home-based TMR program and a self-training upper extremity home exercise group. No between groups differences were found. Within group differences were found in the impairment level for both groups but in the participation level only in the research group. The results point to the potential of using the TMR system to improve the functional use of the upper extremity post-stroke.

Development and Validation of Tele-Health System for Stroke Rehabilitation.

Weiss P.L , Kizony R, Elion O, Harel S, Baum-Cohen I, Krasovsky T, Feldman Y, Shani M. International Conference. Disability, Virtual Reality & Associated Technologies, France, Sep 10-12, 2012.

Abstract:
Tele-rehabilitation refers to the use of information and communication technologies to provide rehabilitation services to people in their homes or other environments. The objective of this paper is to present the development, validation and usability testing of a low-cost, markerless full body tracking virtual reality system designed to provide remote rehabilitation of the upper extremity in patients who have had a stroke. The Methods and Results sections present the progress of our work on system development, system validations and a feasibility/usability study. We conclude with a brief summary of the initial stages of an intervention study and a discussion of our findings in the context of the next steps. The validation study demonstrated considerable accuracy for some outcomes (i.e., shoulder “pitch” angle, elbow flexion, trunk forward and side-to-side deviation). In addition positive responses were received from the clients who participated in the feasibility study. We are currently at the process of improving the accuracy of the system as well as conducting a randomized clinical trial to assess the effectiveness of the system to improve upper extremity function post-stroke.

Obesity & Healthy Living

High success rates of a telemedicine-based intensive treatment program for children with obesity.

Gal Dubnov Raz, Shay Maor, Amit Yaniv, Ishai Aloni, Tomer Ziv Baran. European Congress on Obesity, May 4-7, 2022.

Abstract:

Introduction: Effective treatment of children with obesity mandates numerous clinic visits over a long period of time, resulting in high costs and a very cumbersome process. Telemedicine can ease the treatment burden. During the COVID-19 pandemic, we established a multi-disciplinary treatment program for youth with obesity in our tertiary-care center, to overcome the need for repeated physical clinic visits. Considering its pros and cons, it is unknown if telemedicine-based care differs from on-site care in terms of weight loss and adherence. This study aimed to examine weight and body composition changes following a telemedicine-based, multi-disciplinary intensive treatment program for youth with obesity, compared to historical on-site standard care.

Methods: Seventy children and adolescents with obesity began a novel 6-month treatment program in 2/2020 that included 30, mostly online, consultations with a physician, dietitian, psychologist and exercise physiologist. A smartphone app (Yuvital LTD, Israel) enabled step counts, delivery of healthy lifestyle-related materials and accumulation of digital health tokens redeemed for physical rewards. Anthropometrics and body composition were measured at baseline and after 6 months. Seventy children and adolescents that were treated on-site during 2018-2020, and that had physical measurements in their medical records for over 6 months in our clinic, served as historical controls.

Results: Fifty-six (80%) of participants finished the 6-month program (51% males; mean baseline age 13.1±1.8 years, BMI 29.6±4.7, zBMI 2.0±0.4, fat percent 37.3±7.5). Age and sex did not significantly differ between study groups, while the program participants had a slightly lower baseline mean BMI and body fat percent. After 6 months, BMI and fat precent reductions were seen in 57%, and zBMI reduction in 71%. A clinically meaningful zBMI reduction of >0.2 was seen in 21% of participants. These rates were not statistically significant from those in the historical controls. However, the drop-out rate during the 6-month telemedicine program was only 20%, compared with 81% (181/224) in the historical cohort.

Conclusions: An intensive multi-disciplinary telemedicine-based program for children with obesity can lead to high rates of BMI and fat mass reductions. While these rates did not differ significantly from those seen with in-office visits, a large difference in attrition was seen, in favor of the telemedicine format. Telemedicine can considerably assist children with obesity to stay engaged in successful treatment.

Cardiology & Cardiac Tele-rehabilitation

Remote Pediatric Home Cardiac Monitoring Post-surgery For Congenital Heart Disease

T. Tirosh Wagner, S. Saig, N. Zaid, B. Fizdel, A. Waheeb, U. Katz, 8th World Congress of Pediatric Cardiology and Cardiac Surgery – WCPCCS, Aug 27- Sep 1, 2023

Abstract:

Background: Home environment promotes better recovery for children. The paradigm shift during Covid-19 pandemic towards home hospitalization, technology advancement & the desire to accomplish fast track pediatric cardiac surgery safely, led us to promote novel model for remote Pediatric Home Cardiac Monitoring. Shortly after heart surgery, the child is discharged home and remains under remote supervision using advanced technologies: examination camera, stethoscope and thermometer (Tytocare®), mobile cardiac monitor (Mindray®) and babyscale (Beurer®). Before hospital discharge, the parents receive equipment training, emergency situations guidelines and 24/7 phone for medical advice. During f/u period, morning&evening remote visits are conducted by Pediatric Cardiologist&PCICU nurse. Additional ad-hoc visits are performed if needed. The aim of this study was to examine the quality of care and its contribution to the child's recovery

Methods: Pilot included patients>3m, who underwent heart surgery and parents consented to join program. The children were followed up remotely until physical clinic visit, when parents were asked to fill 6 questions survey regarding satisfaction and contribution of program to child's recovery:1 Did the service contribute to child's recovery? 2 Did the service help to cope with the situation? 3 Did you receive professional response from the staff? 4 Was the staff available for consultation? 5 Was the equipment good&easy to use? 6 Would you recommend the service? Answers were on a scale 1=not satisfy to 5=very satisfy

Results: During 6month study period, 22 families were offered participation, 20 of these joined and 17 answered the survey. Mean child age 4.6yrs, mean f/u 5.6d. Answers (mean): Q1 4.5, Q2 4.8, Q3 4.9, Q4 4.7, Q5 4.6, Q6 5. 2 cases needed re-admission (fever post discharge&supervision d/t decreased fluid intake). 4 potential re-admissions were avoided (decreased appetite, wound infection, 2 cases of fluid retention).

Conclusion: This novel advanced model provides improved continuity & quality of care for discharged patients, accelerates the child's recovery, increases safety and sense of security and decreases re-admissions. Remote home monitoring can lead to reduction of risks from prolonged hospitalization and improve utilization hospital resources.

Remote COPD Monitoring

A Hybrid Home-Care for COPD Patients After an Acute Hospitalization: A Real-life Cohort Study.

Erik Baltaxe , Irena Oksner, Inbal Shafran, Lior S. Seluk, Amir Onn , Galia Barkai, Michael J. Segel. ERS congress, Austria, Sep 10, 2024

Background: The 3-month mortality rate after hospitalization for acute exacerbation of COPD (AECOPD) is 54% In Europe, 35% of the patients are readmitted for COPD exacerbation within three months, while In Israel, 61% of the patients were readmitted within the same period. The main predictor of recurrent and severe exacerbations is the number of previous hospitalizations.
We conducted a real-life cohort study using digital tools to monitor patients at home for 3 months after hospitalization or emergency room admission for AECOPD.
Methods: Prospective cohort study of 50 patients admitted to the Emergency Room or Internal Medicine ward for AECOPD. Screening and recruitment were assisted by automated reports generated by the Sheba Big Data Unit according to pre-specified criteria.
Objectives: To explore the feasability of remote digital monitoring of COPD patients after hospitalization for AECOPD. To identify early signs of respiratory deterioration and establish prompt interventions in order to avoid rehospitalization. To use home spirometry to rapidly confirm or exclude COPD in suspected patients. To enhance quality of life by encouraging physical activity and patient empowerment. To promote patient-centredness and continuity of care in the setting of remote care.
Results: From 8/2022 until 12/2023, 50 patients were recruited, out of 201 eligible subjects. 5 dropped out of the study, 12 exacerbations were reported in 11 patients (1 severe, 7 moderate, 4 mild). 2 patients (4%) died during the follow-up, (1 status epilepticus; 1 CRF complications).
Conclusions: In this ongoing, real-life cohort study we show that: **(1)** remote monitoring of severe COPD patients after an acute exacerbation is feasible and safe. **(2)** The new role of case-manager nurse with technological knowledge can help support large-scale implementation **(3)** The number of AECOPD during follow-up was lower than expected from the literature. **(4)** Patient satisfaction reflected by continuity of care scores significantly improved. **(5)** Low SUS scores suggest ease of use of digital tools by elderly patients and/or their caregivers requires refinement

Gynecologic Oncology

Remote Monitoring and Continuous Care program improves patient experience and outcomes in patients on systemic treatment for gynecologic malignancies.

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IGCS annual meeting Dublin, Oct. 16-18, 2024

Abstract:
Background: Extended patient survival has shifted focus in oncology to patient experience and quality-of-life, measured through patient reported outcome (PROM) instruments. Increasing use of oral therapies and the advent of digital technologies allow scaling back in-person encounters with healthcare teams. Building on pandemic-driven experience, we developed a remote monitoring and continuous care program (RMCC) for gyn oncology patients on systemic treatment, aimed to provide a comprehensive, continuous care experience and to optimize outcomes.
Methods: Patients beginning systemic treatment for gynecologic cancers at a tertiary cancer center are offered enrollment. Following initial multidisciplinary evaluation, patients are monitored with wearable devices for physiological measures and digitally collected PROMs for disease- and treatment-associated symptoms and toxicities, using a customized app (Datos Health). A case-manager follows a virtual dashboard and manages pre-defined system alerts, patient symptoms and concerns with guidance from responsible physicians. Predefined outcomes, including clinical and functional measures, patient experience and healthcare services consumption are collected.
Results: 36 patients have been enrolled (18 ovarian ca, 14 endometrial ca, 3 cervix ca, 1 sarcoma). 30 are receiving 1st line systemic chemotherapy. 7507 system alerts were triggered: 30% by PROMs, 16% by physiologic measures and 42% self-initiated. EORTC PATSAT questionnaires demonstrated high participant satisfaction in healthcare team-dependent domains (Table 2). Patients enrolled in RMCC had fewer ER visits and unplanned admissions per quarter, and more planned supportive ambulatory encounters than patients receiving standard care (n=290)
Conclusions: The use of remote monitoring systems creates a valuable patient experience with high patient satisfaction scores. It also reduces consumption of emergency medical services, and could expand access to tertiary services in remote communities. Increased elective ambulatory service consumption is scalable thanks to virtual care platforms. Longer-term outcomes and associations with changes in physiologic measures will be assessed over time and with a larger patient sample.