

# The role of physical examination in the age of telemedicine

Omar Metwally, MD

Internal Medicine Physician

Highland Hospital

K-6 Adult Medicine Clinic

[ometwally@alamedahealthsystem.org](mailto:ometwally@alamedahealthsystem.org)

# Disclosures

No conflicts of interest

# Educational Objectives

- Review the background for the regulatory changes that prompted recent widespread adoption of telemedicine
- Assess ways that physical examination applies to telemedicine encounters
- Appraise opportunities for high-yield implementation of telemedicine beyond the pandemic

# Table of Contents

- Slide 7–15: Historical Context
- Slide 16–24: Regulatory Changes Prompting Widespread Adoption of Telemedicine
- Slide 25–32: Physical Exam in Telehealth Encounters
- Slide 33–37: Challenges, Disparities & Opportunities

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**IDEAS AND OPINIONS** 278, 280, 283

**EDITORIALS** 285, 287, 289,  
291, 293, 295

**ON BEING A DOCTOR** 297

**AD LIBITUM** 298, 303, 304

**LETTERS** 299

## In the Clinic

Acute Gastrointestinal  
Bleeding ITC17

**ACP Journal Club** JC13

COMPLETE CONTENTS I-5

## ORIGINAL RESEARCH

Characteristics and Outcomes of Hospitalized Pregnant Women With Influenza, 2010 to 2019 149

Associations of Serum Testosterone and Sex Hormone–Binding Globulin With Incident Cardiovascular Events in Middle-Aged to Older Men 159

Comparison of a Hemostatic Powder and Standard Treatment in the Control of Active Bleeding From Upper Nonvariceal Lesions 171

Comparative Effectiveness of an Automated Text Messaging Service for Monitoring COVID-19 at Home 179

Thiamine Supplementation in Patients With Alcohol Use Disorder Presenting With Acute Critical Illness 191

Comparing Video-Based, Telehealth-Delivered Exercise and Weight Loss Programs With Online Education on Outcomes of Knee Osteoarthritis 198

Pregnancy Outcomes in Women With a Prior Cervical Intraepithelial Neoplasia Grade 3 Diagnosis 210

Firearm Purchasing During the COVID-19 Pandemic: Results From the 2021 National Firearms Survey 219

Neutralization of SARS-CoV-2 Variants in Transplant Recipients After Two and Three Doses of mRNA-1273 Vaccine 226

Responses to a Neutralizing Monoclonal Antibody for Hospitalized Patients With COVID-19 According to Baseline Antibody and Antigen Levels 234

## REVIEWS

Safety and Efficiency of Diagnostic Strategies for Ruling Out Pulmonary Embolism in Clinically Relevant Patient Subgroups 244

Video Teleconferencing for Disease Prevention, Diagnosis, and Treatment 256

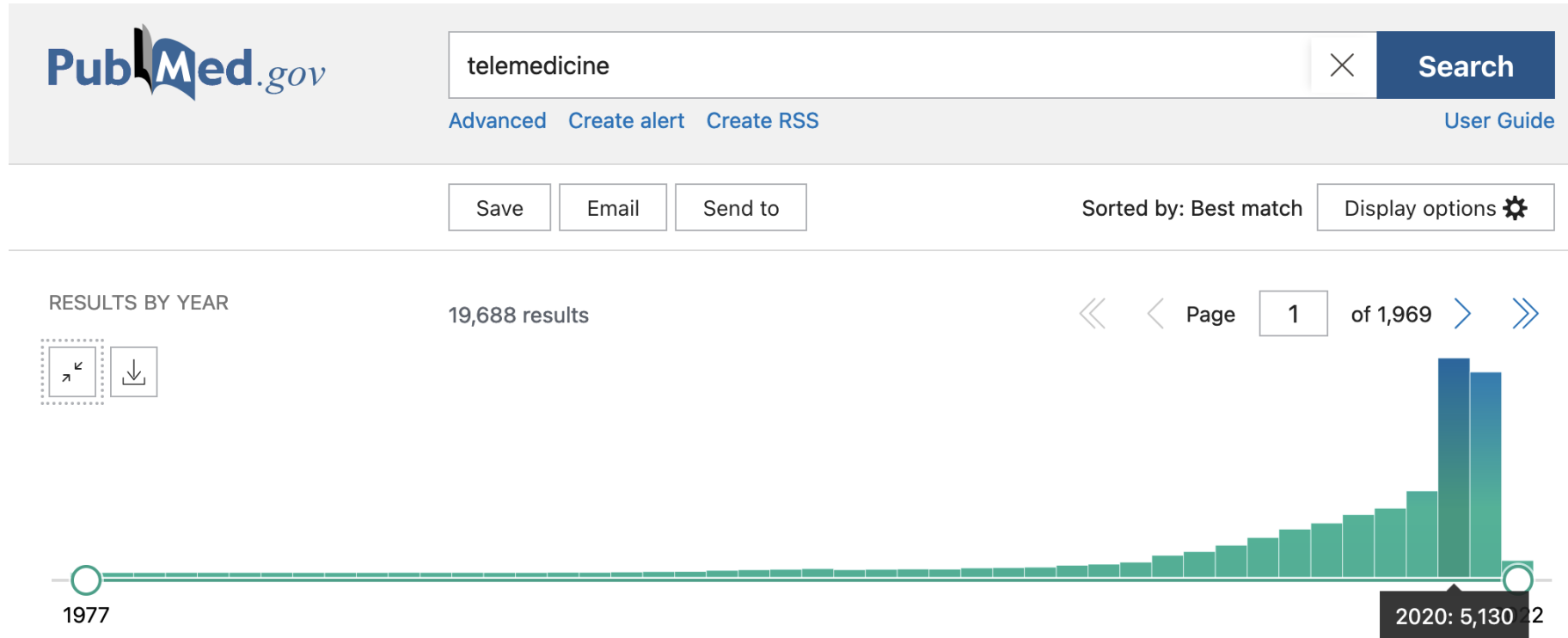
## BEYOND THE GUIDELINES

When and How Would You Screen This Patient for Cervical Cancer? 267


## SPECIAL ARTICLE

COVID-19: Challenging Clinical Questions 276


# Telemedicine Boom



# Telemedicine: 1974-1975

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- ☐ Full text

ARTICLE ATTRIBUTE

- ☐ Associated data

ARTICLE TYPE

- ☐ Books and Documents
- ☐ Clinical Trial

8 results

<< < Page 1 of 1 > >>

- ☐ **Some implications of telemedicine.**
- 1 Park B, Bashshur R.
- Cite J Commun. 1975 Summer;25(3):161-6. doi: 10.1111/j.1460-2466.1975.tb00619.x.
- Share PMID: 1184778 No abstract available.
- ☐ **[The telemedicine system].**
- 2 Santiago CI.
- Cite Bol Col Prof Enferm P R. 1975 Jun;1(2):21.
- Share PMID: 1059419 Spanish. No abstract available.
- ☐ **Telemedicine system: the missing link between homes and hospitals?**
- 3 Mark RG.
- Cite Mod Nurs Home. 1974 Feb;32(2):39-42.
- Share PMID: 4493180 No abstract available.
- ☐ **Laser mediated telemedicine in anesthesia.**
- 4 Gravenstein JS, Berzina-Moettus L, Regan A, Pao YH.
- Cite Anesth Analg. 1974 Jul-Aug;53(4):605-9.
- Share PMID: 4858254 No abstract available.

ARTICLE TYPE

- ☐ Books and Documents
- ☐ Clinical Trial
- ☐ Meta-Analysis
- ☐ Randomized Controlled Trial
- ☐ Review
- ☐ Systematic Review

PUBLICATION DATE

- ☐ 1 year
- ☐ 5 years
- ☐ 10 years
- ☐ Custom Range

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- ☐ **Laser mediated telemedicine in anesthesia.**
- 4 Gravenstein JS, Berzina-Moettus L, Regan A, Pao YH.
- Cite Anesth Analg. 1974 Jul-Aug;53(4):605-9.
- Share PMID: 4858254 No abstract available.
- ☐ **[The telemedicine system in Puerto Rico].**
- 5 Santiago CI.
- Cite Bol Col Prof Enferm P R. 1975 Mar;1(1):19-20.
- Share PMID: 1059416 Spanish. No abstract available.
- ☐ **Quantitative electrocardiography during extended space flight.**
- 6 Smith RF, Stanton K, Stoop D, Brown D, King PH.
- Cite Acta Astronaut. 1975 Jan-Feb;2(1-2):89-102. doi: 10.1016/0094-5765(75)90046-6.
- Share PMID: 11841097
- One astronaut had occasional premature ventricular contractions (PVC) during the pre- and postflight phases. He had a single episode of multiple PVC's during heavy-load exercise testing in flight. A second astronaut had no arrhythmia during pre- or inflight testing. On pos ...
- ☐ **A mobile health service for migrant families.**
- 7 DARRAH W.
- Cite Nurs Outlook. 1962 Mar;10:172-5.
- Share PMID: 13883602 No abstract available.
- ☐ **Development of Skylab medical equipment and flight preparations.**
- 8 Johnston RS, Stonesifer JC, Hawkins WR.
- Cite Acta Astronaut. 1975 Jan-Feb;2(1-2):69-84. doi: 10.1016/0094-5765(75)90044-2.
- Share PMID: 11841095



# SkyLab



First U.S. space station (May 1973 – February 1974)



# 1973: Historical Context

- Jan 8: Watergate Scandal
- Jan 22: Roe v Wade
- Jan 23: End of Vietnam War
- March 1: Pink Floyd's *Dark Side of the Moon*

# Skylab Experiments

> [Acta Astronaut.](#) Jan-Feb 1975;2(1-2):89-102. doi: 10.1016/0094-5765(75)90046-6.

Acta astronautica

## Quantitative electrocardiography during extended space flight

R F Smith <sup>1</sup>, K Stanton, D Stoop, D Brown, P H King

Affiliations + expand

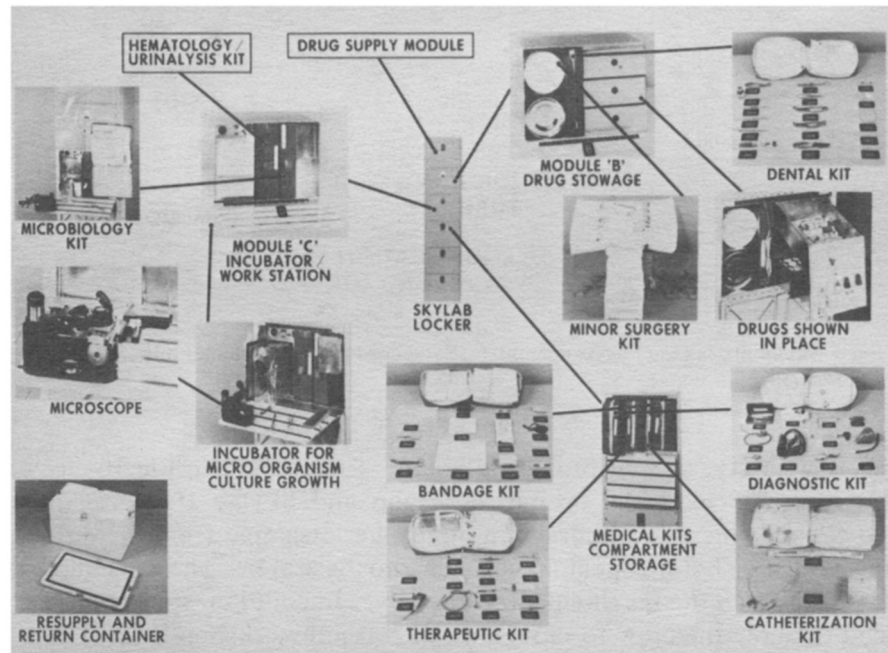
PMID: 11841097 DOI: [10.1016/0094-5765\(75\)90046-6](#)

### Abstract

To assess the effects of prolonged space flight on the electrophysiological properties of the heart, vectorcardiograms (VCG) were obtained on the Skylab crews at regular intervals during flight and the pre- and postflight periods. The VCG signals were telemetered from Skylab and analyzed by digital computer. Conventional 12-lead electrocardiograms were derived from the VCG signals by a lead transformation program. Standardized exercise loads were incorporated into the experiment protocol to increase the sensitivity of the VCG for effects of deconditioning and to detect susceptibility for arrhythmias. In Skylab II, 24 preflight, 21 inflight, and 19 postflight experiments were analyzed. Statistically significant inflight changes observed in two or more crew members included: decreased resting heart rate, increased QRS duration, anterior shift QRS vector, increased QRS vector magnitude, anterior shift T vector, and increased T vector magnitude. One astronaut had occasional premature ventricular contractions (PVC) during the pre- and postflight phases. He had a single episode of multiple PVC's during heavy-load exercise testing in flight. A second astronaut had no arrhythmia during pre- or inflight testing. On postflight day 21 he had multiple PVC's and salvos of ectopic ventricular beats. He has had no recurrence of the arrhythmia. With the exception of the cardiac arrhythmias, no deleterious electrophysiological changes were observed during Skylab II.

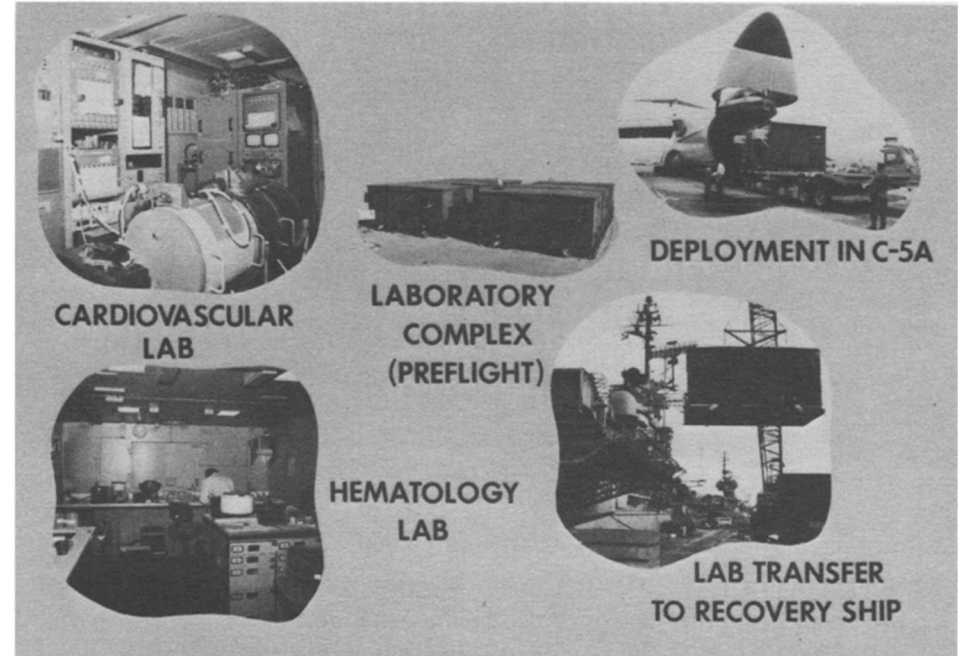
# SkyLab: Forerunner to ISS

- Nearly 300 experiments spanning life sciences, physics, astronomy, material sciences
  - Focus on “reaction of [hu]man[s] to the environment of space” and understanding health impacts of long-term weightlessness on humankind
  - <https://history.nasa.gov/EP-107/ch5.htm>
  - <https://www.nasa.gov/content/40-years-ago-skylab-paved-way-for-international-space-station>
- 2002 Nobel Prize for physics awarded to Dr Riccardo Giacconi, a founder of X-ray astronomy
  - Utilized data collected from SkyLab
  - <https://www.cosmos.esa.int/web/xmm-newton/nobel>



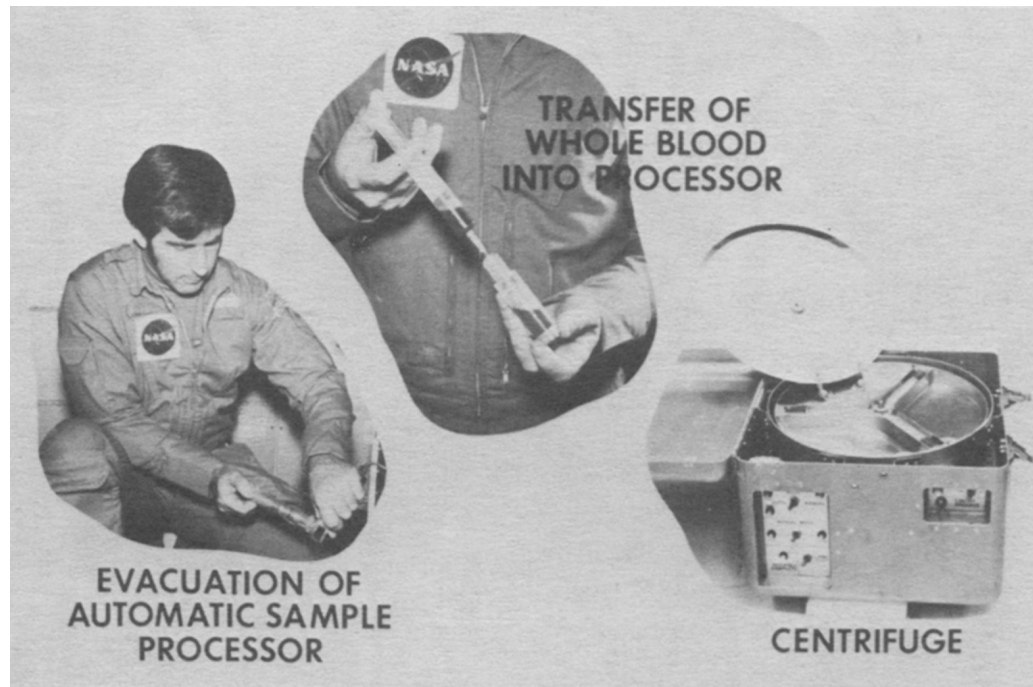
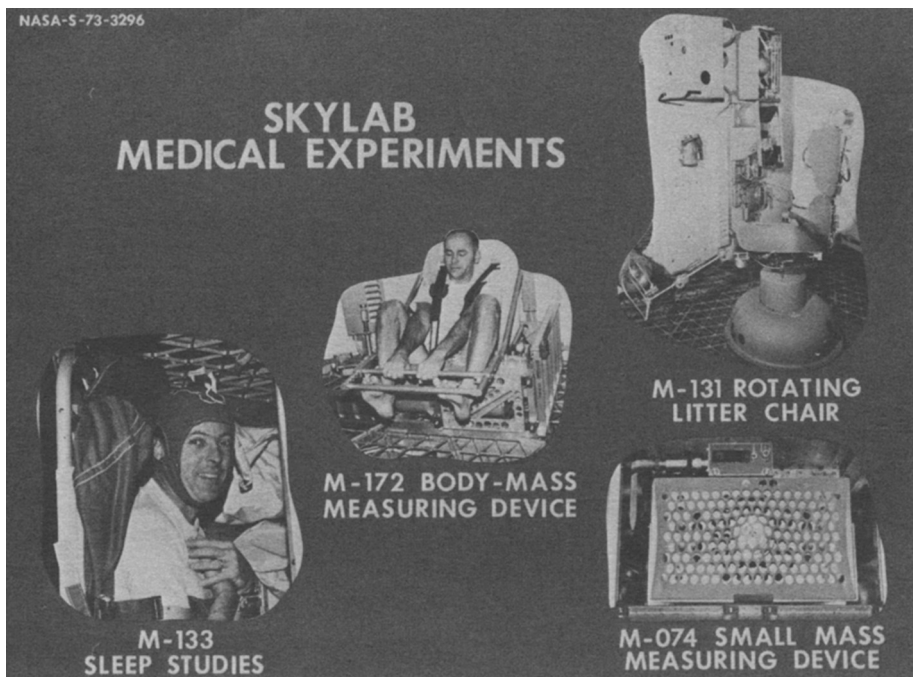
# SkyLab Medical Research

- Baseline health data collection began months before liftoff
  - Weight, water intake, urine output, caloric intake, exercise
  - Heart rate, blood pressure, cardiac telemetry
- Data telemetered through range stations to Mission Control Center
- (Near-)Real-Time data



<https://ntrs.nasa.gov/citations/19750051537>

# SkyLab Medical Laboratories



# Telemedicine Reimbursement Pre-Pandemic

- Prior to 1135 waiver, CMS reimbursement contingent on patient being located in a designated rural area and must physically present to a medical facility
- In 2019, Medicare began reimbursing for “Virtual Check-Ins” (patient-initiated encounter with a healthcare practitioner) and “E-visits” (asynchronous, patient-initiated communications)

# SSA Section 1135 Waiver

Social Security Act, Section 1135 authorizes the Secretary of the Department of Health and Human Services to **waive or modify** certain Medicare, Medicaid, CHIP, and HIPAA **requirements**.

The President must have declared an **emergency or disaster** under either the Stafford Act or the National Emergencies Act; and:

The Secretary of HHS must have declared a **Public Health Emergency** under Section 319 of the Public Health Service Act

Then, with respect to the **geographic area(s) and time periods** provided for in those declarations, the Secretary may elect to authorize waivers/modifications of one or more of the requirements described in Section 1135(b).

<https://www.cms.gov/about-cms/emergency-preparedness-response-operations/current-emergencies/coronavirus-waivers>



# SSA Section 1135 Waiver, Continued...

- Section 1135 waivers are finite in time and can be limited to a geographic location
- Original COVID-19 PHE declared on 3/6/2020
- HHS Secretary Xavier Becerra extended PHE declaration another 90 days (beyond 1/14/2022)

<https://www.cms.gov/about-cms/emergency-preparedness-response-operations/current-emergencies/coronavirus-waivers>

# Renewal of Determination That A Public Health Emergency Exists

As a result of the continued consequences of the Coronavirus Disease 2019 (COVID-19) pandemic, on this date and after consultation with public health officials as necessary, I, Xavier Becerra, Secretary of Health and Human Services, pursuant to the authority vested in me under section 319 of the Public Health Service Act, do hereby renew, effective January 16, 2022, the January 31, 2020, determination by former Secretary Alex M. Azar II, that he previously renewed on April 21, 2020, July 23, 2020, October 2, 2020, and January 7, 2021, and that I renewed on April 15, 2021, July 20, 2021, and October 18, 2021 that a public health emergency exists and has existed since January 27, 2020, nationwide.

January 14, 2022

/s/

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Date

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Xavier Becerra

- <https://aspr.hhs.gov/legal/PHE/Pages/COVID19-14Jan2022.aspx>

# Pandemic-Driven Expansion of Telemedicine

- “Telehealth, telemedicine, and related terms generally refer to the exchange of medical information from one site to another through electronic communication to improve a patient’s health.” [CMS]
- Contemporary telemedicine result of patients’ need for healthcare while minimizing infection risk to all
- Under new waiver, Medicare can pay for office, hospital, and other visits furnished via telehealth across the country and including in patient’s homes, as of **March 6, 2020**.
- Allows physicians, nurse practitioners, clinical psychologists, and licensed clinical social workers to offer telehealth to their patients
- <https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet>

# Summary of Medicare Telemedicine Services

TYPE OF SERVICE	WHAT IS THE SERVICE?	HCPSC/CPT CODE	Patient Relationship with Provider
<b>MEDICARE TELEHEALTH VISITS</b>	A visit with a provider that uses telecommunication systems between a provider and a patient.	<p>Common telehealth services include:</p> <ul style="list-style-type: none"> <li>• 99201-99215 (Office or other outpatient visits)</li> <li>• G0425-G0427 (Telehealth consultations, emergency department or initial inpatient)</li> <li>• G0406-G0408 (Follow-up inpatient telehealth consultations furnished to beneficiaries in hospitals or SNFs)</li> </ul> <p>For a complete list:  <a href="https://www.cms.gov/Medicare/Medicare-General-Information/Telehealth/Telehealth-Codes">https://www.cms.gov/Medicare/Medicare-General-Information/Telehealth/Telehealth-Codes</a></p>	<p>For new* or established patients.</p> <p>*To the extent the 1135 waiver requires an established relationship, HHS will not conduct audits to ensure that such a prior relationship existed for claims submitted during this public health emergency</p>
<b>VIRTUAL CHECK-IN</b>	A brief (5-10 minutes) check in with your practitioner via telephone or other telecommunications device to decide whether an office visit or other service is needed. A remote evaluation of recorded video and/or images submitted by an established patient.	<ul style="list-style-type: none"> <li>• HCPCS code G2012</li> <li>• HCPCS code G2010</li> </ul>	For established patients.
<b>E-VISITS</b>	A communication between a patient and their provider through an online patient portal.	<ul style="list-style-type: none"> <li>• 99421</li> <li>• 99422</li> <li>• 99423</li> <li>• G2061</li> <li>• G2062</li> <li>• G2063</li> </ul>	For established patients.

# CMS Guidance on Medicare FFS Billing

- Services should only be reported as telehealth services when the individual physician or **practitioner** furnishing the service is **not at the same location** as the **beneficiary**.
- Medicare telehealth services are services that would normally occur in person but are instead conducted via telecommunications technology and are **paid at the full in-person rate**.
- Service such as the **virtual check-in, eVisits, remote evaluation, and telephone visits** are not services that would normally occur in person, and are not paid as though the service occurred in person.

Source: “COVID-19 Frequently Asked Questions (FAQs) on Medicare Fee-for-Service (FFS) Billing”

[https://www.cdc.gov/csels/dls/locs/2020/cms\\_issues\\_updated\\_COVID-19\\_faqs\\_about\\_medicare\\_billing.html](https://www.cdc.gov/csels/dls/locs/2020/cms_issues_updated_COVID-19_faqs_about_medicare_billing.html)

<https://www.cms.gov/files/document/03092020-covid-19-faqs-508.pdf>

<https://www.cms.gov/files/document/03092020-covid-19-faqs-508.pdf>

# Virtual History-Taking Tools

- Telehealth services covered under 1135:
  - <https://www.cms.gov/Medicare/Medicare-General-Information/Telehealth/Telehealth-Codes>
- Generally, CMS requires most telehealth services to be delivered via telecommunications technology that has **audio and video** capabilities that are used for **two-way, real-time interactive communication**
- Notification of Enforcement Discretion for Telehealth Remote Communications During the COVID-19 Nationwide Public Health Emergency
  - Allows providers to use popular video chat apps with patients
  - E.g. Apple FaceTime, Google Hangouts, Zoom, Skype, FB Messenger
  - <https://www.hhs.gov/hipaa/for-professionals/special-topics/emergency-preparedness/notification-enforcement-discretion-telehealth/index.html>

# CMS Reimbursement Criteria for Telemedicine Encounters

“CMS has used its waiver authority to allow, beginning on March 1, 2020, telephone evaluation and management codes and certain counseling behavioral health care and educational services, to be furnished as telehealth services using audio-only communications technology (telephones or other audio-only devices). A list of those services is available here” (page 74):

<https://www.cms.gov/Medicare/Medicare-General-Information/Telehealth/Telehealth-Codes>

99202	Office/outpatient visit new
99203	Office/outpatient visit new
99204	Office/outpatient visit new
99205	Office/outpatient visit new
99211	Office/outpatient visit est
99212	Office/outpatient visit est
99213	Office/outpatient visit est
99214	Office/outpatient visit est
99215	Office/outpatient visit est



# Role of Physical Exam in Telemedicine: Professional Society Guidance

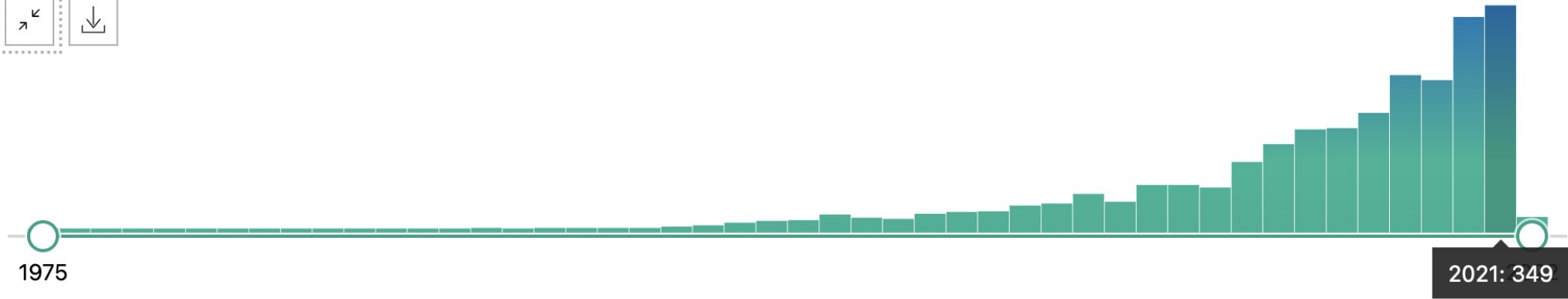
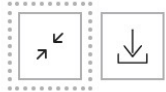
- Emerging field
- No concrete professional society guidance (yet)
  - ACP
  - AMA indications and contra-indications (*Telehealth Implementation Playbook*)
- Evidence Base

# PubMed Query: (telemedicine) AND (physical examination)

RESULTS BY YEAR

2,120 results

Page 1 of 212



# PubMed Query: (telemedicine) AND (physical examination)

## ☐ Clinical Examination Component of Telemedicine, Telehealth, mHealth, and Connected Health Medical Practices.

1 Weinstein RS, Krupinski EA, Doarn CR.  
Cite Med Clin North Am. 2018 May;102(3):533-544. doi: 10.1016/j.mcna.2018.01.002.  
Share PMID: 29650074 Review.  
Telemedicine and telehealth are the practices of medicine at a distance. Performing the equivalent of a complete clinical examination by telemedicine would be unusual. However, components of a more traditional clinical examination are part of the te ...

## ☐ The Telemedicine Musculoskeletal Examination.

2 Laskowski ER, Johnson SE, Shelerud RA, Lee JA, Rabatin AE, Driscoll SW, Moore BJ, Wainberg MC, Terzic CM.  
Cite Mayo Clin Proc. 2020 Aug;95(8):1715-1731. doi: 10.1016/j.mayocp.2020.05.026.  
Share PMID: 32753146 Free PMC article. Review.  
In recent weeks, there has been a significant amount of information and advice on how to best approach telemedicine visits. Given the frequent presentation of individuals with musculoskeletal complaints to the medical practitioner, it is important to have a framework for t ...

## ☐ Telemedicine During COVID-19 and Beyond: A Practical Guide and Best Practices Multidisciplinary Approach for the Orthopedic and Neurologic Pain Physical Examination.

3 Wahezi SE, Duarte RA, Yerra S, Thomas MA, Pujar B, Sehgal N, Argoff C, Manchikanti L, Gonzalez D, Jain R, Kim CH, Hossack M, Senthelal S, Jain A, Leo N, Shaparin N, Wong D, Wong A, Nguyen K, Singh JR, Grieco G, Patel A, Kinon MD, Kaye AD.  
Cite Pain Physician. 2020 Aug;23(4S):S205-S238.  
Share PMID: 32942812 Free article.  
CONCLUSIONS: The physical examination is an essential component for sound clinical judgment and patient care planning. The physical examinations described in this manuscript provide a comprehensive framework for the musculoskeletal and neurologic examinati ...

## ☐ Telemedicine in the Era of COVID-19: The Virtual Orthopaedic Examination.

4 Tanaka MJ, Oh LS, Martin SD, Berkson EM.  
Cite J Bone Joint Surg Am. 2020 Jun 17;102(12):e57. doi: 10.2106/JBJS.20.00609.  
Share PMID: 32341311 Free PMC article.  
With the onset of the COVID-19 pandemic, the shifting of clinical care to telemedicine visits has been hastened. Because of current limitations in resources, many elective surgeons have been forced to venture into utilizing telemedicine, in which the standards for o ...

## ☐ Telemedicine and M-Health in Hypertension Management: Technologies, Applications and Clinical Evidence.

5 Omboni S, Caserini M, Coronetti C.  
Cite High Blood Press Cardiovasc Prev. 2016 Sep;23(3):187-96. doi: 10.1007/s40292-016-0143-6. Epub 2016 Apr 12.  
Share PMID: 27072129 Review.  
Such solutions are currently referred as e-health, the most popular and widely distributed being those based on telemedicine and mobile health (m-health). A specific application of telemedicine for hypertension management is blood pressure telemonitoring (BPT), whic ...

## ☐ The value of physical examination in the era of telemedicine.

6 Lee PS, Koo S, Panter S.  
Cite J R Coll Physicians Edinb. 2021 Mar;51(1):85-90. doi: 10.4997/JRCPE.2021.122.  
Share PMID: 33877145  
When reviewing newly referred or long-term patients, different specialty clinics have different requirements for physical examination. Clinicians prefer face-to-face consultations at the initial visit to establish a doctor-patient relationship; telephone or video co ...

## ☐ Telemedicine in Orthopedic Oncology During COVID-19: Patient Satisfaction, Reimbursement, and Physical Examination Competency.

7 Lawrenz JM, Krout JC, Moran CP, Ready AK, Schafer EA, Higgins RT, Halpern JL, Schwartz HS, Holt GE.  
Cite Orthopedics. 2021 Sep-Oct;44(5):274-279. doi: 10.3928/01477447-20210819-09. Epub 2021 Sep 1.  
Share PMID: 34590949  
The clinical competency of telemedicine visits was measured by delayed or missed diagnoses and surgical site infections that may be attributable to lack of an in-person physical examination. ...However, the limitations of lack of an in-person physical ...

## ☐ Performing nutrition assessment remotely via telehealth.

8 Mauldin K, Gieng J, Saarony D, Hu C.  
Cite Nutr Clin Pract. 2021 Aug;36(4):751-768. doi: 10.1002/ncp.10682. Epub 2021 Jun 8.  
Share PMID: 34101249 Review.  
Performing nutrition assessment remotely via telehealth is a topic of significant interest given the global pandemic in 2020 that has necessitated physical distancing and virtual communications. This review presents an evidence-based approach to conducting nutrition assess ...

# Remote Patient Monitoring

P: Among patients with chronic disease

I: Does remote digital monitoring

C: Compared to standard episodic care

O: Reduce acute care use?

Reduce morbidity and/or mortality?

Improve quality of life?

# RPM Challenges

- Heterogenous interventions complicate analysis of evidence base
  - Numerous confounding variables
- Is the app helping, or a phone call from clinic?
- Motivational drop off
- Little evidence supporting quantitative benefits

# RPM: Diabetes Mellitus Type 2

- “The impact of *telehealth* remote patient monitoring on glycemic control in type 2 diabetes”
  - Lee PA et al, BMC Health Serv Res. 2018; 18: 495.
  - Systematic review and meta-analysis of systematic reviews of randomised controlled trials
  - telehealth interventions produced a small but significant improvement in HbA1c levels compared with usual care
  - The greatest effect was seen in telephone-delivered interventions, followed by Internet blood glucose monitoring system interventions

# RPM: Heart Failure

- “Effectiveness of Remote Patient Monitoring After Discharge of Hospitalized Patients With Heart Failure”
  - Ong MK et al. JAMA Intern Med 2016 Mar;176(3):310–8.
  - Randomized 1437 patients hospitalized for HF to the intervention arm (715 patients) or to the usual care arm (722 patients)
  - Intervention arm combined telehealth coaching and digital monitoring
  - No change in readmission rate



# Effect of RPM on Acute Care Utilization

- “Does remote patient monitoring reduce acute care use? A systematic review”
  - Taylor ML et al. BMJ Open. 2021; 11(3): e040232.
  - 91 studies of RPM interventions on CVD and COPD
  - RPM reduced admissions in 49% of studies, LOS (49%), and ED visits (41%)
  - Wide range of interventions
  - “RPM can reduce acute care use for patients with cardiovascular disease and COPD. However, effectiveness varies within and between populations.”

# Disparities in Healthcare

- Telemedicine shift puts certain populations at further disadvantage
  - Older adults
  - Racial/ethnic minority status
  - Low socioeconomic status
  - Low health literacy
  - Non-native English speakers
- At least 1 in every 4 Americans may not have digital literacy skills or access to Internet-enabled digital devices to engage in video visits.
- Source: “Addressing Equity in Telemedicine for Chronic Disease Management During the Covid-19 Pandemic.” Nouri et al. *NEJM Catalyst*, 4 May 2020.

# Healthcare Disparities in Telemedicine

FIGURE 1

## Patient Visits by Age, Language, and Insurance Before and After Telemedicine Scale-Up

This chart shows the proportion of patient visits seen by age, language preference, and insurance type prior to (2/17–2/28/2020) and after (3/23–4/3/2020) scaled-up telemedicine implementation to address the Covid-19 pandemic at the UCSF General Internal Medicine Primary Care Practice (P=0.002 for age  $\geq 65$  and P<0.001 for other comparisons). A significantly smaller proportion of visits after scaled-up telemedicine implementation were with vulnerable patients.

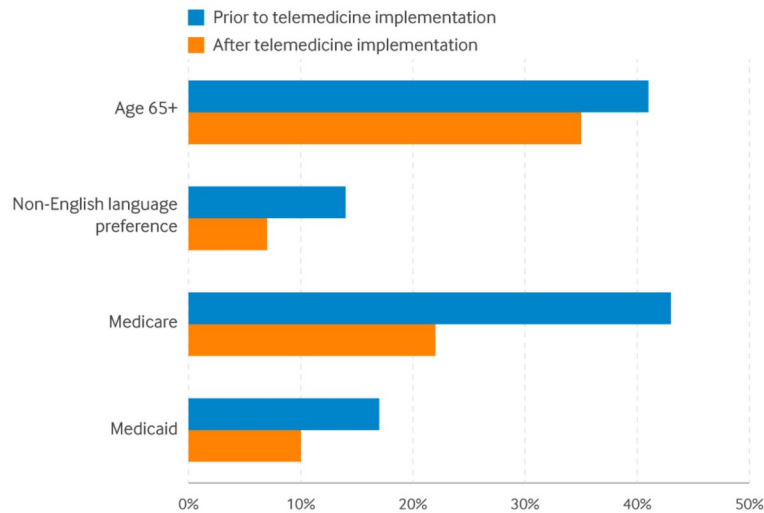
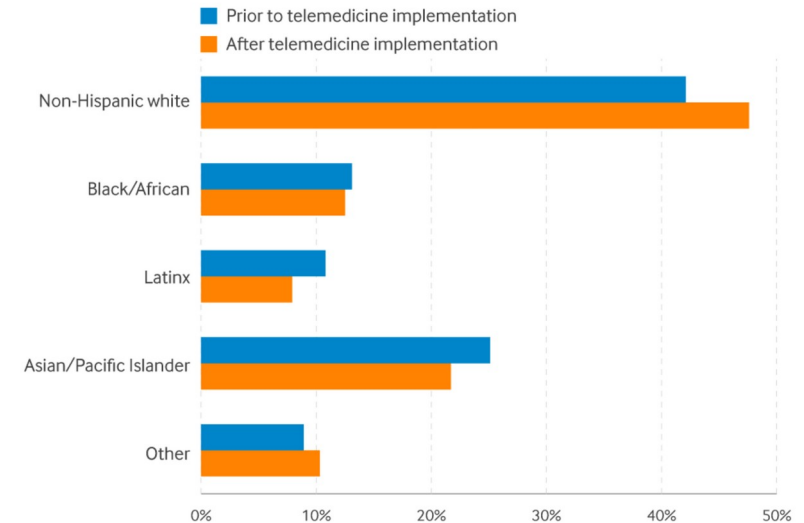


FIGURE 2

## Patient Visits by Race/Ethnicity Before and After Telemedicine Scale-Up

This chart shows the proportion of patient visits seen by patient race/ethnicity prior to (2/17–2/28/2020) and after (3/23–4/3/2020) scaled-up telemedicine implementation to address the Covid-19 pandemic at the UCSF General Internal Medicine Primary Care Practice (P=0.006 using chi-squared test). A smaller proportion of visits with vulnerable populations occurred after implementation.



Source: “Addressing Equity in Telemedicine for Chronic Disease Management During the Covid-19 Pandemic.” Nouri et al. *NEJM Catalyst*, 4 May 2020.

# Tele-commuting

- Download & Upload speeds
- Latency
- Recommended minimum download speed of 1 Mbps for video call (5-25 Mbps for “telecommuting”)
- Source: FCC Broadband Speed Guide available at:  
<https://www.fcc.gov/consumers/guides/broadband-speed-guide>
- Consider assessing patient’s technical capabilities
  - Speeds, data, device, app

# Future Directions

- Convenience and ease of access for some...
- ...Barriers to telehealth for others...
- Relative lag in preventive healthcare services during pandemic
  - “A qualitative study of high-performing primary care practices during the COVID-19 pandemic.” Albert et al. 25 Nov 2021. BMC Fam Pract. 2021; 22: 237.
- Reimbursement after Public Health Emergency ends?

# Opportunities and Open Questions

“Our findings indicate that primary care structures and processes developed for **remote chronic disease management and preventive care are evolving rapidly.**

Emerging adapted care processes, most notably remote provision of care, are promising and may endure beyond the pandemic, but **issues of equity must be addressed** (e.g., through payment reform) to ensure vulnerable populations receive the same benefit.”

“A qualitative study of high-performing primary care practices during the COVID-19 pandemic.” Albert et al. 25 Nov 2021. BMC Fam Pract. 2021; 22: 237.

# Personal Experience at Highland Hospital's Adult Medicine Clinic

- Remote precepting
  - Need for WiFi range extenders!
- Direct video calls with patients
  - Doximity
- COVID-19 management & results disclosure



# Take-Home Points

- Recent widespread adoption of telemedicine prompted by (short-term?) regulatory changes
- Audio/visual patient-provider communication is most important element of telemedicine encounter
- Utility of RPM is TBD and requires focused use cases
- Telemedicine beyond pandemic: Primary care and chronic disease management

# Thank You!

I am grateful to Dr David Tian, K-6, the Department of Medicine, and Highland Hospital for the opportunity to deliver care to a diverse patient population, gain experience in the emerging field of telemedicine, and contribute to applied informatics.

- Omar Metwally, MD