Date of preparation: 03/31/2022

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Place of Birth: Orlando, FL
Citizenship: USA

ACADEMIC APPOINTMENTS, HOSPITAL APPOINTMENTS, AND OTHER WORK EXPERIENCE

Academic Appointments

07/2022 - present	**Columbia University College of Physicians & Surgeons** Assistant Professor, Department of Medicine, Division of Cardiology Assistant Professor, Department of Biomedical Informatics	New York, NY
07/2022 - present	**NewYork-Presbyterian Hospital** Medical Director for Artificial Intelligence and Advanced Analytics	New York, NY

Hospital Appointments

07/2022 - present	**NewYork Presbyterian/Columbia University Irving Medical Center** Cardiology Attending	New York, NY

Other Work Experience

08/2013 – 11/2015	**Lumiata** Clinician Data Scientist	San Francisco, CA

EDUCATION

07/2011 – 07/2016	**Duke University School of Medicine** MD, July 2016	Durham, NC
07/2007 – 07/2011	**Rice University** BA in Sociology, July 2007	Houston, TX

TRAINING

07/2018 – 06/2022	**Department of Medicine, Columbia University** Cardiology Fellow	New York, NY
07/2016 – 06/2018	**Department of Medicine, Columbia University** Internal Medicine Resident	New York, NY

LICENSURE AND BOARD CERTIFICATION

New York State Physician License #: 301355 (exp 11/31/2022)
Board Certification in Internal Medicine (exp 04/01/2031)

HONORS AND AWARDS

American Society for Clinical Investigation Emerging Generation Award (top 20 junior physician-scientists), 2022

STAT Wunderkind (top 25 innovative researchers under rank of Asst Prof in the US), 2020

Silverman Fellow for Health Innovation, 2019

TEDMED Frontline Scholarship, 2012, 2013, 2014

Duke AOA Day Best Patient-Oriented Platform Presentation, 2014

Institute for Healthcare Improvement Patient Safety Scholarship, 2012

Microsoft Imagine Cup World, Mobile - 3rd Place, 2011

Rice University Envision Grant, 2010-2011

Franz and Frances Brotzen Award for Service, 2011

Brown College President's Award, 2010

Trustee's Distinguished Scholarship from Rice University, 2007-2011

Finger Fellowship for Sustainable Health, 2009-2012

Chandler Davidson Researcher Award, Rice University Dept. of Sociology, 2010

ACADEMIC SERVICE

04/2022 – 04/2025	**American College of Cardiology** Health Care Innovation Leadership Council	New York, NY

- Guide programming, education, and advocacy activities for ACC.
- Coordinate working groups in advanced analytics, digital health and devices, entrepreneurship, precision health, and virtual care.

PROFESSIONAL ORGANIZATIONS AND SOCIETIES

Journal Reviewer

- Journal of the American College of Cardiology
- European Heart Journal
- Journal of the American Medical Informatics Association
- Journal of the American Heart Association
- Nature Scientific Reports
- Lancet Digital Health
- American College of Cardiology Scientific Sessions

Member

- American College of Cardiology
- American Medical Informatics Association
- American Heart Association
- American Society of Clinical Investigators

FELLOWSHIP AND GRANT SUPPORT

PRESENT SUPPORT

Janssen Pharmaceutical / J&J, New Brunswick, NJ **November 2021 – December 2023**
Clinical Trial, Industry (co-investigator)

Identification of light chain cardiac amyloidosis using deep learning

- Principal Investigator: Tim Poterucha, MD. Amount: $348,940
- Supports the development of a deep learning model for the detection of light chain cardiac amyloidosis (AL-CA) from ECG in various myeloproliferative populations.

Pfizer, New York, NY **May 2021 – December 2022**
Clinical Trial, Industry (co-investigator)

Prospective identification of transthyretin cardiac amyloidosis using deep learning

- Principal Investigator: Mat Maurer, MD. Amount: $258,000
- Supports the Cardiac Amyloidosis Discovery Trial, a 100 patient study which aims to prospectively validate a model for the diagnosis of transthyretin cardiac amyloidosis.

Edwards Life Sciences, Irvine, CA **December 2020 – December 2022**
Clinical Trial, Industry (Principal Investigator)

Detection of valvular heart disease using deep learning analysis of electrocardiography

- Principal Investigator: Pierre Elias, MD. Amount: $214,000
- Supports the ValveNet Trial, a 200 patient study which aims to prospectively validate a deep learning algorithm using ECG to detect moderate to severe valvular heart disease.

Eidos Therapeutics, San Francisco, CA **December 2020 – December 2022**
Clinical Trial, Industry (co-investigator)

Prospective identification of transthyretin cardiac amyloidosis using deep learning

- Principal Investigator: Mat Maurer, MD. Amount: $100,000
- Supports the Cardiac Amyloidosis Discovery Trial, a 100 patient study which aims to prospectively validate a model for the diagnosis of transthyretin cardiac amyloidosis.

Google Cloud, San Francisco, CA **December 2020 – December 2022**
Research Infrastructure, Industry (Principal Investigator)

Creating a deep learning environment for cardiovascular imaging

- Principal Investigator: Pierre Elias, MD. Amount: $30,000
- Supports the development of the Cardiovascular and Radiologic Deep Learning Environment (CRADLE) infrastructure and cross-institutional collaboration.

PAST SUPPORT

Columbia University, New York, NY **June 2020 – June 2021**
T32 Fellowship (T32HL007854)

- Principal Investigator: Steven Marx, MD. Amount: $85,000
- Supports the development of the Cardiovascular and Radiologic Deep Learning Environment (CRADLE) where we create and validate novel deep learning models to detect cardiovascular disease earlier, with a focus on convolutional neural networks for cardiac imaging.

EDUCATIONAL CONTRIBUTIONS

04/2022	**American College of Cardiology Scientific Sessions** Data Science & Machine Learning in Cardiology: How to Get Started	Washington, DC
	• Lead an annual 3-hour workshop walking participants through the basics of machine learning, how to start a successful career in the field, and specific software packages that can assist in developing research in cardiovascular machine learning.	
11/2021	**American Medical Informatics Association Annual Conference** Data Science & Machine Learning in Cardiology: How to Get Started	San Diego, CA
	• Lead an annual 3-hour workshop walking participants through the basics of machine learning, how to start a successful career in the field, and specific software packages that can assist in developing research in cardiovascular machine learning.	
01/2021 – 06/2021	**Columbia University Data Science Institute** Machine Learning Project Mentor	New York, NY
	• Mentored 5 master's students alongside Dr Adler Perotte to develop a machine learning software package called IntroECG to simplify the practice of deep learning on electrocardiograms. • IntroECG remains the first package to provide a comprehensive solution to the application of deep learning for electrocardiographic waveforms and is used at over a dozen institutions across the US.	
09/2014 – 06/2017	**Duke Clinical Research Institute** 10-Year ASCVD Risk App for SMART on FHIR	Durham, NC
	• Developed shared-decision making SMART on FHIR app to inform >10,000 patients of CVD risk, now used at over a dozen Cerner sites across the country.	

PATENTS & INVENTIONS

A Deep Learning Algorithm for the Detection of Aortic Stenosis by Electrocardiogram

U.S. Provisional Application No. 63/223,135 filed July 19, 2021

PUBLICATIONS

ORIGINAL, PEER-REVIEWED RESEARCH PUBLICATIONS IN PRINT OR OTHER MEDIA

Elias P*, Poterucha T*, Rajaram V, Matos Moller L, Rodriguez V, Bhave S, Hahn R, Tison G, Abreau S, Barrios J, Torres J, Hughes JW, Perez M, Kodali S, Khalique O, Hamid N, Schwartz A, Homma S, Cohen D, Maurer M, Einstein A, Nazif T, Leon M, Perotte A. Detection of aortic stenosis, aortic regurgitation, and mitral regurgitation using deep learning analysis of electrocardiography. [Manuscript accepted to Journal of the American College of Cardiology]. *Co-first authors

Topkara V, **Elias P**, Jain R, Sayer G, Burkhoff D, Uriel N. Machine Learning Based Prediction of Myocardial Recovery in Patients with Left Ventricular Assist Device Support. [In Press Circulation: Heart Failure]

Poterucha TJ, **Elias P**, Ruberg FL, DeLuca A, Kinkhabwala M, Johnson LL, Griffin JM, Pandey S, Einstein AJ, Maurer MS. False Positive 99mTc-Pyrophosphate Scanning Leading to Inappropriate Tafamidis Prescriptions. JACC Cardiovasc Imaging. 2021 Oct;14(10):2042-2044. doi: 10.1016/j.jcmg.2021.04.006. Epub 2021 May 19. PMID: 34023264.

Rubin GA, Desai AD, Chai Z, Wang A, Chen Q, Wang AS, Kemal C, Baksh H, Biviano A, Dizon JM, Yarmohammadi H, Ehlert F, Saluja D, Rubin DA, Morrow JP, Avula UMR, Berman JP, Kushnir A, Abrams MP, Hennessey JA, **Elias P**, Poterucha TJ, Uriel N, Kubin CJ, LaSota E, Zucker J, Sobieszczyk ME, Schwartz A, Garan H, Waase MP, Wan EY. Cardiac Corrected QT Interval Changes Among Patients Treated for COVID-19 Infection During the Early Phase of

the Pandemic. JAMA Netw Open. 2021 Apr 1;4(4):e216842. doi: 10.1001/jamanetworkopen.2021.6842. PMID: 33890991; PMCID: PMC8065381.

Rodriguez VA, Bhave S, Chen R, Pang C, Hripcsak G, Sengupta S, Elhadad N, Green R, Adelman J, Metitiri KS, **Elias P**, Groves H, Mohan S, Natarajan K, Perotte A. Development and validation of prediction models for mechanical ventilation, renal replacement therapy, and readmission in COVID-19 patients. J Am Med Inform Assoc. 2021 Jul 14;28(7):1480-1488. doi: 10.1093/jamia/ocab029. PMID: 33706377; PMCID: PMC7989331.

Gupta A, Madhavan MV, Poterucha TJ, DeFilippis EM, Hennessey JA, Redfors B, Eckhardt C, Bikdeli B, Platt J, Nalbandian A, **Elias P**, Cummings MJ, Nouri SN, Lawlor M, Ranard LS, Li J, Boyle C, Givens R, Brodie D, Krumholz HM, Stone GW, Sethi SS, Burkhoff D, Uriel N, Schwartz A, Leon MB, Kirtane AJ, Wan EY, Parikh SA. Association between antecedent statin use and decreased mortality in hospitalized patients with COVID-19. Nat Commun. 2021 Feb 26;12(1):1325. doi: 10.1038/s41467-021-21553-1. PMID: 33637713; PMCID: PMC7910606.

Yarmohammadi H, Morrow JP, Dizon J, Biviano A, Ehlert F, Saluja D, Waase M, **Elias P**, Poterucha TJ, Berman J, Kushnir A, Abrams MP, Rubin GA, Jou S, Hennessey J, Uriel N, Wan EY, Garan H. Frequency of Atrial Arrhythmia in Hospitalized Patients With COVID-19. Am J Cardiol. 2021 May 15;147:52-57. doi: 10.1016/j.amjcard.2021.01.039. Epub 2021 Feb 20. PMID: 33617812; PMCID: PMC7895683.

Ostropolets A, **Elias PA**, Reyes MV, Wan EY, Pajvani UB, Hripcsak G, Morrow JP. Metformin Is Associated With a Lower Risk of Atrial Fibrillation and Ventricular Arrhythmias Compared With Sulfonylureas: An Observational Study. Circ Arrhythm Electrophysiol. 2021 Mar;14(3):e009115. doi: 10.1161/CIRCEP.120.009115. Epub 2021 Feb 7. PMID: 33554609; PMCID: PMC7969445.

Poterucha TJ*, **Elias P***, Bokhari S, Einstein AJ, DeLuca A, Kinkhabwala M, Johnson LL, Flaherty KR, Saith SE, Griffin JM, Perotte A, Maurer MS. Diagnosing Transthyretin Cardiac Amyloidosis by Technetium Tc 99m Pyrophosphate: A Test in Evolution. JACC Cardiovasc Imaging. 2021 Jun;14(6):1221-1231. doi: 10.1016/j.jcmg.2020.08.027. Epub 2020 Nov 18. PMID: 33221204; PMCID: PMC8113330. *Co-first authors

Poterucha TJ*, **Elias P*,** Jain SS, Sayer G, Redfors B, Burkhoff D, Rosenblum H, DeFilippis EM, Gupta A, Lawlor M, Madhavan MV, Griffin J, Raikhelkar J, Fried J, Clerkin KJ, Kim A, Perotte A, Maurer MS, Saluja D, Dizon J, Ehlert FA, Morrow JP, Yarmohammadi H, Biviano AB, Garan H, Rabbani L, Leon MB, Schwartz A, Uriel N, Wan EY. Admission Cardiac Diagnostic Testing with Electrocardiography and Troponin Measurement Prognosticates Increased 30-Day Mortality in COVID-19. J Am Heart Assoc. 2021 Jan 5;10(1):e018476. doi: 10.1161/JAHA.120.018476. Epub 2020 Nov 10. PMID: 33169643; PMCID: PMC7955502. *Co-first authors

Poterucha TJ, **Elias P**, Ruberg FL, DeLuca A, Kinkhabwala M, Johnson LL, Maurer MS, Einstein AJ. The importance of SPECT cardiac reconstruction for accurate 99m-Tc-pyrophosphate interpretation in TTR amyloidosis. J Nucl Cardiol. 2020 Oct 28. doi: 10.1007/s12350-020-02409-5. Epub ahead of print. PMID: 33118142.

Abrams MP, Wan EY, Waase MP, Morrow JP, Dizon JM, Yarmohammadi H, Berman JP, Rubin GA, Kushnir A, Poterucha TJ, **Elias PA**, Rubin DA, Ehlert F, Biviano A, Uriel N, Garan H, Saluja D. Clinical and cardiac characteristics of COVID-19 mortalities in a diverse New York City Cohort. J Cardiovasc Electrophysiol. 2020 Dec;31(12):3086-3096. doi: 10.1111/jce.14772. Epub 2020 Oct 20. PMID: 33022765; PMCID: PMC7675758.

Elias P*, Poterucha TJ*, Jain SS, Sayer G, Raikhelkar J, Fried J, Clerkin K, Griffin J, DeFilippis EM, Gupta A, Lawlor M, Madhavan M, Rosenblum H, Roth ZB, Natarajan K, Hripcsak G, Perotte A, Wan EY, Saluja A, Dizon J, Ehlert F, Morrow JP, Yarmohammadi H, Kumaraiah D, Redfors B, Gavin N, Kirtane A, Rabbani L, Burkhoff D, Moses J, Schwartz A, Leon M, Uriel N. The Prognostic Value of Electrocardiogram at Presentation to Emergency Department in Patients With COVID-19. Mayo Clin Proc. 2020 Oct;95(10):2099-2109. doi: 10.1016/j.mayocp.2020.07.028. Epub 2020 Aug 15. PMID: 33012341; PMCID: PMC7428764. *Co-first authors

Gupta A, Madhavan MV, Poterucha TJ, DeFilippis EM, Hennessey JA, Redfors B, Eckhardt C, Bikdeli B, Platt J, Nalbandian A, **Elias P**, Cummings MJ, Nouri SN, Lawlor M, Ranard LS, Li J, Boyle C, Givens R, Brodie D, Krumholz HM, Stone GW, Sethi SS, Burkhoff D, Uriel N, Schwartz A, Leon MB, Kirtane AJ, Wan EY, Parikh SA. Association Between Antecedent Statin Use and Decreased Mortality in Hospitalized Patients with COVID-19. Res Sq

[Preprint]. 2020 Aug 11:rs.3.rs-56210. doi: 10.21203/rs.3.rs-56210/v1. Update in: Nat Commun. 2021 Feb 26;12(1):1325. PMID: 32818209; PMCID: PMC7430584.

Jain SS, Liu Q, Raikhelkar J, Fried J, **Elias P**, Poterucha TJ, DeFilippis EM, Rosenblum H, Wang EY, Redfors B, Clerkin K, Griffin JM, Wan EY, Abdalla M, Bello NA, Hahn RT, Shimbo D, Weiner SD, Kirtane AJ, Kodali SK, Burkhoff D, Rabbani LE, Schwartz A, Leon MB, Homma S, Di Tullio MR, Sayer G, Uriel N, Anstey DE. Indications for and Findings on Transthoracic Echocardiography in COVID-19. J Am Soc Echocardiogr. 2020 Oct;33(10):1278-1284. doi: 10.1016/j.echo.2020.06.009. Epub 2020 Jun 17. PMID: 32782131; PMCID: PMC7298489.

Elias P, Peterson E, Wachter B, Ward C, Poon E, Navar AM. Evaluating the Impact of Interruptive Alerts within a Health System: Use, Response Time, and Cumulative Time Burden. Appl Clin Inform. 2019 Oct;10(5):909-917. doi: 10.1055/s-0039-1700869. Epub 2019 Nov 27. PMID: 31777057; PMCID: PMC6881214.

Navar AM, Pencina MJ, Mulder H, **Elias P,** Peterson ED. Improving patient risk communication: Translating cardiovascular risk into standardized risk percentiles. Am Heart J. 2018 Apr;198:18-24. doi: 10.1016/j.ahj.2017.12.005. Epub 2017 Dec 7. PMID: 29653642; PMCID: PMC5901888.

Elias P, Khanna R, Dudley A, Davies J, Jacolbia R, McArthur K, Auerbach AD. Automating Venous Thromboembolism Risk Calculation Using Electronic Health Record Data upon Hospital Admission: The Automated Padua Prediction Score. J Hosp Med. 2017 Apr;12(4):231-237. doi: 10.12788/jhm.2714. PMID: 28411291.

Elias P, Damle A, Cassale M, Branson K, Peterson N, Churi C, Komatireddy R, Feramisco J. Metadata Correction: A Web-Based Tool for Patient Triage in Emergency Department Settings: Validation Using the Emergency Severity Index. JMIR Med Inform. 2015 Jun 15;3(3):e24. doi: 10.2196/medinform.4816. Erratum for: JMIR Med Inform. 2015 Jun 10;3(2):e23. PMID: 26268527; PMCID: PMC5834116.

Sah S, **Elias P**, Ariely D. Investigation momentum: the relentless pursuit to resolve uncertainty. JAMA Intern Med. 2013 May 27;173(10):932-3. doi: 10.1001/jamainternmed.2013.401. PMID: 23588200.

Elias P, Rajan NO, McArthur K, Dacso CC. InSpire to Promote Lung Assessment in Youth: Evolving the Self-Management Paradigms of Young People With Asthma. Med 2 0. 2013 May 21;2(1):e1. doi: 10.2196/med20.2014. PMID: 25075232; PMCID: PMC4084766.

OTHER PEER-REVIEWED PUBLICATIONS IN PRINT OR OTHER MEDIA

Elias P*, Bhave S*, Poterucha T, Rodriguez V, Leb J, Mutasa S, Ouyang D, Lungren M, Ashley E, Maurer M, Einstein A, Uriel N, Perotte A. LVHnet: A deep learning model for detecting cardiac structural abnormalities from chest X-rays. [Preprint]. *Co-first authors

REVIEWS, CHAPTERS, MONOGRAPHS, EDITORIALS

Elias P. As telehealth visits become more common, here are ways you can make the most of your consultation. The Washington Post. Apr 3, 2021.

Elias P (ack. Wachter B). “Insensible Losses: When the Medical Community Forgets the Family” Health Affairs. 2015 Apr;34(4):707-10. doi: 10.1377/hlthaff.2014.0536.

BOOKS/TEXTBOOKS FOR MEDICAL OR SCIENTIFIC COMMUNITY

Elias P, Poterucha T, Randazzo M, Einstein A. “Role of machine learning and artificial intelligence for electrocardiograms” in Biondi-Zoccai et al (Ed. 1), Invasive and non-invasive cardiovascular imaging: role of machine learning and artificial intelligence. [Preprint]

Elias P, Dahhan, T. “Hypoxemia” In B. Leppert (Ed. 1), Netter's Integrated Review of Medicine (pp. 23-1-23-4). Elsevier (2019).

INVITED AND/OR PEER-SELECTED PRESENTATIONS AT REGIONAL, NATIONAL OR INTERNATIONAL LEVELS:

Throw Away Your Stethoscope: New Ways of Diagnosing Valvular Heart Disease. American College of Cardiology Scientific Sessions. Washington, DC. April 3, 2022.

Faculty vs Entrepreneur vs Faculty-Entrepreneur: Having your cake and eating it too. American College of Cardiology Scientific Sessions. Washington, DC. April 3, 2022.

Machine Learning Applications in Cardiology. Courant Institute for Mathematical Sciences. New York, NY. January 4th, 2022.

Machine Learning in Cardiology: How to get started. American Medical Informatics Association. San Diego, CA. November 1, 2021.

LVHnet: A deep learning model for detecting cardiac structural abnormalities from chest X-rays. American Medical Informatics Association. San Diego, CA. November 1, 2021.

Machine Learning Applications in Cardiology. Columbia University Department of Biomedical Informatics Research Seminar. New York, NY. October 11th, 2021.

ValveNet: Detection of aortic stenosis, aortic regurgitation, and mitral regurgitation using deep learning analysis of electrocardiograms. TVT Structural Heart Summit. Miami, FL. July 21st, 2021.

LVHnet: A deep learning model for detecting cardiac structural abnormalities from chest X-rays. American College of Cardiology. New Orleans, LA. May 26, 2021.

LVHnet: A deep learning model for detecting cardiac structural abnormalities from chest X-rays. Machine Learning for Healthcare. December 4th, 2020.

Machine Learning Applications in Cardiology. Cedars Sinai Medical Center Machine Learning Journal Club. Los Angeles, CA. January 27th, 2021.

The Future of Digital Health in Cardiology. American Heart Association. Chicago, IL. November 17, 2019.

Health Affairs Briefing: The cost and quality of cancer care. National Press Club**,** Washington, DC, April 7, 2015.

Development of a Novel Venous Thromboembolism Prediction Algorithm Utilizing Health Record Data-Mining. Duke University AOA Day, Durham, NC, August 8, 2014.

InSpire to PLAY (Promote Lung Assessment in Youth): Evolving the Self-Management Paradigms of Young People with Asthma. Medicine 2.0 Congress at Stanford University, Palo Alto, CA, September 16-18, 2011.

InSpire: Evolving the self-management and adherence paradigms of young people with asthma. American Public Health Association Annual Meeting, Denver, CO, November 6-10, 2010.

Development of Novel Mobile Applications to Improve Chronic Illness Management. Serious Games and Virtual Environments Day at Texas A&M University, College Station, TX, May 13, 2010.

InSpire to PLAY: Promoting Lung Assessment in Youth. Inaugural Collaborative Research and Evidence Based Practice Conference by The Methodist Hospital and New York-Presbyterian Hospital, Houston, TX, April 21-22, 2010.