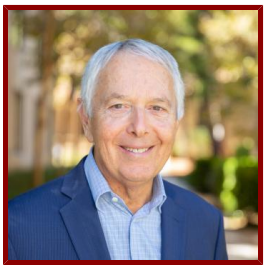
Stanford



Arnold Milstein

Professor of Medicine (General Medical Discipline)

Medicine - Primary Care and Population Health

NIH Biosketch available Online Curriculum Vitae available Online

CONTACT INFORMATION

- **Alternate Contact**

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Bio

BIO

Dr. Milstein is a Professor of Medicine at Stanford and directs the University's Clinical Excellence Research Center. The Center engages faculty from Health, Computer, and Social Sciences in the discovery and replication of innovative health care delivery methods that safely lower per capita health care spending for excellent care.

Before joining Stanford's faculty, his career of applied research spanned private and public sector healthcare delivery and policy. After creating a healthcare performance improvement firm that he expanded globally following its acquisition by Mercer, he co-founded three nationally influential public benefit initiatives, the Leapfrog Group in partnership with the Business Roundtable in 1998 and the Consumer Purchaser Alliance in 2001. Appointed to consecutive term as a Congressional MedPAC Commissioner, he originated two subsequently enacted legislative changes to improve the value of healthcare. He was a founding staff member and serves as the Medical Director of the Pacific Business Group on Health (PBGH), the largest employer-led regional healthcare improvement coalition in the U.S.

Citing his national impact on innovation in health care policy and delivery methods, he was selected for the highest annual award of both the National Business Group on Health (NBGH) and of the American College of Medical Quality. Elected to the Institute of Medicine (now, NAM) of the National Academy of Sciences, he chaired the planning committee of its workshop series on best methods to lower per capita health care spending and improve clinical outcomes. He was educated at Harvard (BA–Economics), Tufts (MD) and UC Berkeley (MPH Healthcare Evaluation).

ACADEMIC APPOINTMENTS

- Professor, Medicine - Primary Care and Population Health
- Faculty Affiliate, Institute for Human-Centered Artificial Intelligence (HAI)
- Member, Wu Tsai Neurosciences Institute

PROFESSIONAL EDUCATION

- MPH, University of California, Berkeley , Health Care Evaluation
- Residency, Mount Zion Hospital, SF , Psychiatry

- Internship, Mount Zion Hospital, SF , Medicine & Psychiatry
- MD, Tufts University , Medicine
- BA, Harvard Univerisity , Economics

LINKS

- Clinical Excellence Research Center: https://med.stanford.edu/cerc.html
- Partnership in AI-assisted Care: https://med.stanford.edu/pacresearch.html

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Design national demonstration of innovations in care delivery that provide more with less. Informed by research on AI-assisted clinical workflow, positive value outlier analysis and triggers of loss aversion bias among patients and clinicians.

Research on creation of a national index of health system productivity gain.

CLINICAL TRIALS

- Spine Pain INtervention to Enhance Care Quality And Reduce Expenditure, Not Recruiting

PROJECTS

- Post-Doctoral Mentor - Stanford (2022 - present)
- Graduate Student Mentor - Stanford University

Teaching

COURSES

2025-26

- AI-Assisted Care: BIOE 277, CS 337, MED 277, PSYC 278 (Aut)

2024-25

- AI-Assisted Care: CS 337, MED 277 (Aut)

2023-24

- AI-Assisted Care: CS 337, MED 277 (Aut)

Publications

PUBLICATIONS

- **Employee preferences in health plan design: results from a national survey.** *Health affairs scholar*
  Kaplan, R. M., Nikolov, M. C., Pfeffer, J., Milstein, A., Singer, S. J.
  2026; 4 (6): qxag120
- **A Lay Health Worker-Led Symptom Intervention and Acute Care Use in Older Adults With Cancer: A Randomized Clinical Trial.** *JAMA*
  Patel, M. I., Voskanyan, M., Agajanian, H., Agajanian, R., Podnos, Y., Milstein, A.
  2025
- **Exploring State-Level Change in Health Care Value Over Three Decades in the United States, 1991-2020.** *Health services research*
  Lescinsky, H., Sahu, M., Beauchamp, M., Crosby, S., Johnson, E., McHugh, T. A., Scott, J. W., Schulman, K., Thomson, A., Weil, M., Dieleman, J. L., Milstein, A.
  2025: e70054

- **Systematic Exploration of Hospital Cost Variability: A Conformal Prediction-Based Outlier Detection Method for Electronic Health Records.** *AMIA Joint Summits on Translational Science proceedings. AMIA Joint Summits on Translational Science*
  Grolleau, F., Goh, E., Ma, S. P., Masterson, J., Ross, T., Milstein, A., Chen, J. H.
  2025; 2025: 187-195
- **To Err Is Human: Failing to Reduce Overall Harm Is Inhumane.** *American journal of medical quality : the official journal of the American College of Medical Quality*
  Pronovost, P. J., Austin, J. M., Milstein, A.
  2025
- **Physician clinical decision modification and bias assessment in a randomized controlled trial of AI assistance.** *Communications medicine*
  Goh, E., Bunning, B., Khoong, E. C., Gallo, R. J., Milstein, A., Centola, D., Chen, J. H.
  2025; 5 (1): 59
- **Artificial intelligence-powered 3D analysis of video-based caregiver-child interactions.** *Science advances*
  Weng, Z., Bravo-Sánchez, L., Wang, Z., Howard, C., Xenochristou, M., Meister, N., Kanazawa, A., Milstein, A., Bergelson, E., Humphreys, K. L., Sanders, L. M., Yeung-Levy, S.
  2025; 11 (7): eadp4422
- **GPT-4 assistance for improvement of physician performance on patient care tasks: a randomized controlled trial.** *Nature medicine*
  Goh, E., Gallo, R. J., Strong, E., Weng, Y., Kerman, H., Freed, J. A., Cool, J. A., Kanjee, Z., Lane, K. P., Parsons, A. S., Ahuja, N., Horvitz, E., Yang, et al
  2025
- **From Laggard To Leader: Why Health Care In The United States Is Failing, And How To Fix It.** *Health affairs (Project Hope)*
  Berwick, D. M., Batchlor, E., Chokshi, D. A., Gabow, P., Gilfillan, R., Isasi, F., Milstein, A., Nichols, L. M.
  2025: 101377hlthaff202401007
- **Developing ICU Clinical Behavioral Atlas Using Ambient Intelligence and Computer Vision** *Developing ICU Clinical Behavioral Atlas Using Ambient Intelligence and Computer Vision;*
  Milstein, A.
  2025; 2
- **Parenthood and Paychecks-The Gender Pay Gap in Medicine.** *JAMA*
  Kim, K. M., Narayan, A., Shah, N. R., Milstein, A.
  2024
- **Testing and Evaluation of Health Care Applications of Large Language Models: A Systematic Review.** *JAMA*
  Bedi, S., Liu, Y., Orr-Ewing, L., Dash, D., Koyejo, S., Callahan, A., Fries, J. A., Wornow, M., Swaminathan, A., Lehmann, L. S., Hong, H. J., Kashyap, M., Chaurasia, et al
  2024
- **Large Language Model Influence on Diagnostic Reasoning: A Randomized Clinical Trial.** *JAMA network open*
  Goh, E., Gallo, R., Hom, J., Strong, E., Weng, Y., Kerman, H., Cool, J. A., Kanjee, Z., Parsons, A. S., Ahuja, N., Horvitz, E., Yang, D., Milstein, et al
  2024; 7 (10): e2440969
- **Long-Term Engagement of Patients With Advanced Cancer: Results From the EPAC Randomized Clinical Trial.** *JAMA oncology*
  Patel, M. I., Agrawal, M., Blayney, D. W., Bundorf, M. K., Milstein, A.
  2024
- **Safety vs price in the generic drug market: metformin.** *The American journal of managed care*
  Teasdale, B., Hudspeth, A., Kucera, K., Light, D., Nailor, J., Williams, S., Milstein, A., Schulman, K. A.
  2024; 30 (4): 161-168
- **Association between maternal employment status and presence of children with major congenital anomalies in Denmark.** *BMC public health*
  Kim, K. M., Farkas, D. K., Wong, V., Hjorth, C. F., Horváth-Puhó, E., Cahan, E., Cohen, E., Shah, N. R., Sørensen, H. T., Milstein, A.
  2024; 24 (1): 715
- **Evidence for changes in screen use in the US during early childhood related to COVID-19 pandemic parent stressors.** *JMIR pediatrics and parenting*

Glassman, J., Humphreys, K. L., Jauregui, A., Milstein, A., Sanders, L.
2024

- **Innovation Diffusion Across 13 Specialties and Associated Clinician Characteristics.** *Advances in health care management*
  Novikov, Z., Singer, S. J., Milstein, A.
  2024; 22

- **Artificial Intelligence Identifies Factors Associated with Blood Loss and Surgical Experience in Cholecystectomy** *Artificial Intelligence Identifies Factors Associated with Blood Loss and Surgical Experience in Cholecystectomy*
  Milstein, A.
  2024

- **Caring for People With Depression: Costs Among 43 Million Commercially Insured Patients With or Without Comorbid Illnesses.** *Annals of behavioral medicine : a publication of the Society of Behavioral Medicine*
  Glassman, J. R., Jauregui, A., Milstein, A., Kaplan, R. M.
  2023

- **Effect of a Biopsychosocial Intervention or Postural Therapy on Disability and Health Care Spending Among Patients With Acute and Subacute Spine Pain: The SPINE CARE Randomized Clinical Trial.** *JAMA*
  Choudhry, N. K., Fifer, S., Fontanet, C. P., Archer, K. R., Sears, E., Bhatkhande, G., Haff, N., Ghazinouri, R., Coronado, R. A., Schneider, B. J., Butterworth, S. W., Deogun, H., Cooper, et al
  2022; 328 (23): 2334-2344

- **Improving adherence to guidelines for spine pain care: what tools could support primary care clinicians in conforming to guidelines?** *BMJ open quality*
  Fifer, S. K., Choundry, N. K., Brod, M., Hsu, E., Milstein, A.
  2022; 11 (3)

- **Identifying solutions to meet unmet needs of family caregivers using human-centered design.** *BMC geriatrics*
  Termglinchan, V., Daswani, S., Duangtaweesub, P., Assavapokee, T., Milstein, A., Schulman, K.
  1800; 22 (1): 94

- **The Dysfunctional Health Benefits Market and Implications for US Employers and Employees.** *JAMA*
  Scheinker, D., Milstein, A., Schulman, K.
  1800

- **Reducing administrative costs in US health care: Assessing single payer and its alternatives.** *Health services research*
  Scheinker, D., Richman, B. D., Milstein, A., Schulman, K. A.
  2021

- **Parents' Perspectives on Using Artificial Intelligence to Reduce Technology Interference During Early Childhood: Cross-sectional Online Survey.** *Journal of medical Internet research*
  Glassman, J., Humphreys, K., Yeung, S., Smith, M., Jauregui, A., Milstein, A., Sanders, L.
  2021; 23 (3): e19461

- **Estimating health care delivery system value for each US state and testing key associations.** *Health services research*
  Dieleman, J. L., Kaldjian, A. S., Sahu, M., Chen, C., Liu, A., Chapin, A., Scott, K. W., Aravkin, S., Zheng, P., Mokdad, A., Murray, C. J., Schulman, K., Milstein, et al
  2021

- **A Cost Comparison of Cataract Surgeries in Three Countries — United States, India, and Nepal** *NEJM Catalyst|Innovations in Care Delivery*
  Xue, J., Hinkle, J., Reeves, M., Zheng, L., Natarajan, V., Vyas, S., Upreti Oli, R., Oliva, M., Kaplan, R. S., Milstein, A., Tabin, G., Goldberg, J. L., Schulman, et al
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- **Ethical issues in using ambient intelligence in health-care settings.** *The Lancet. Digital health*
  Martinez-Martin, N., Luo, Z., Kaushal, A., Adeli, E., Haque, A., Kelly, S. S., Wieten, S., Cho, M. K., Magnus, D., Fei-Fei, L., Schulman, K., Milstein, A.
  2020

- **Computer vision's potential to improve health care.** *Lancet (London, England)*
  Milstein, A., Topol, E. J.

2020; 395 (10236): 1537

- **Slowing Medicare Spending by Optimizing Late-Life Needs** *NEJM CATALYST INNOVATIONS IN CARE DELIVERY*
  Rinaldo, F., Altman, M., Cannon, K., Platchek, T., Shah, N. R., Kaplan, R. M., Milstein, A.
  2020; 1 (4)
- **Illuminating the dark spaces of healthcare with ambient intelligence.** *Nature*
  Haque, A. n., Milstein, A. n., Fei-Fei, L. n.
  2020; 585 (7824): 193–202
- **Societal costs associated with mothers of children with major congenital anomalies: a population-based matched cohort study in Denmark.** *BMJ public health*
  Kim, K. M., Horváth-Puhó, E., Narayan, A., Wong, V., Skipper, N., Shah, N. R., Cohen, E., Toft Sørensen, H., Milstein, A.
  2026; 4 (2): e003969
- **A framework of digital biomarkers for neurodegenerative diseases** *NATURE REVIEWS BIOENGINEERING*
  Nerrise, F., Schutz, N., Zhao, Q., Gould, C., Milstein, A., Schulman, K., Henderson, V. W., Landay, J., Fei-Fei, L., Lin, F., Adeli, E.
  2026
- **A framework of digital biomarkers for neurodegenerative diseases.** *Nature reviews bioengineering*
  Nerrise, F., Schütz, N., Zhao, Q., Gould, C., Milstein, A., Schulman, K., Henderson, V. W., Landay, J., Fei-Fei, L., Lin, F. V., Adeli, E.
  2026
- **Improving care of older adults with cancer: A randomized trial.**
  Patel, M. I., Agajanian, H. H., Voskanyan, M., Agajanian, R., Milstein, A.
  LIPPINCOTT WILLIAMS & WILKINS.2025: 11002
- **Developing ICU Clinical Behavioral Atlas Using Ambient Intelligence and Computer Vision.** *NEJM AI*
  Dai, W., Adeli, E., Luo, Z., Dash, D., Lakshmikanth, S., Durante, Z., Tang, P., Kaushal, A., Milstein, A., Fei-Fei, L., Schulman, K.
  2025; 2 (2)
- **Right Patient, Right Specialist, Right Time: Retrieval Augmented Generation for Specialty Referral Routing.** *AMIA ... Annual Symposium proceedings. AMIA Symposium*
  Haredasht, F. N., Goh, E., Ravi, V., Ashtari, P., Jiang, Y., Yuldashev, N., Grolleau, F., Gallo, R. J., Shah, A., Hur, E., Chopra, K., Jee, O., Lee, et al
  2024; 2024: 443-450
- **ChatGPT Influence on Medical Decision-Making, Bias, and Equity: A Randomized Study of Clinicians Evaluating Clinical Vignettes.** *medRxiv : the preprint server for health sciences*
  Goh, E., Bunning, B., Khoong, E., Gallo, R., Milstein, A., Centola, D., Chen, J. H.
  2023
- **Engagement of Patients with Advanced Cancer (EPAC) randomized clinical trial: Long-term effects on survival and healthcare use**
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  LIPPINCOTT WILLIAMS & WILKINS.2023
- **Biopsychosocial Intervention or Postural Therapy in Patients With Spine Pain Reply** *JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*
  Hsu, E., Milstein, A., Choudhry, N.
  2023; 329 (16): 1408-1409
- **Using Case Mix Index within Diagnosis-Related Groups to Evaluate Variation in Hospitalization Costs at a Large Academic Medical Center.** *AMIA ... Annual Symposium proceedings. AMIA Symposium*
  Pi, S., Masterson, J., Ma, S. P., Corbin, C. K., Milstein, A., Chen, J. H.
  2023; 2023: 1201-1208
- **A computational approach to measure the linguistic characteristics of psychotherapy timing, responsiveness, and consistency.** *Npj mental health research*
  Miner, A. S., Fleming, S. L., Haque, A., Fries, J. A., Althoff, T., Wilfley, D. E., Agras, W. S., Milstein, A., Hancock, J., Asch, S. M., Stirman, S. W., Arnow, B. A., Shah, et al
  2022; 1 (1): 19

- **Care teams misunderstand what most upsets patients about their care.** *Healthcare (Amsterdam, Netherlands)*
  Conner, A. L., Podtschaske, B. V., Mazza, M. C., Zionts, D. L., Malcolm, E. J., Thomson, C. C., Singer, S. J., Milstein, A.
  2022; 10 (4): 100657
- **State-level differences in duties permitted to be performed by medical assistants in the delivery of eye care**
  Reeves, M., Xue, J., Milstein, A., Tabin, G., Goldberg, J. L., Schulman, K.
  ASSOC RESEARCH VISION OPHTHALMOLOGY INC.2022
- **Design of the Spine Pain Intervention to Enhance Care Quality And Reduce Expenditure Trial (SPINE CARE) study: Methods and lessons from a multi-site pragmatic cluster randomized controlled trial.** *Contemporary clinical trials*
  Choudhry, N. K., Fontanet, C. P., Ghazinouri, R., Fifer, S., Archer, K. R., Haff, N., Butterworth, S. W., Deogun, H., Block, S., Cooper, A., Sears, E., Goyal, P., Coronado, et al
  2021: 106602
- **Distilling innovative US autism care programs that address widely perceived unmet patient and family needs.** *Autism : the international journal of research and practice*
  Wong, V., Pham, M., Godfrey, K., Milstein, A.
  2021: 13623613211027999
- **Influence of a COVID-19 vaccine's effectiveness and safety profile on vaccination acceptance.** *Proceedings of the National Academy of Sciences of the United States of America*
  Kaplan, R. M., Milstein, A.
  2021; 118 (10)
- **Caring for Caregivers: Bridging the Gap Between Family Caregiving Policy and Practice** *NEJM Catalyst: Innovations in Care Delivery*
  Wong, V., Rosenbaum, S., Sung, W., Kaplan, R. M., Bott, N., Platchek, T., Milstein, A., Shah, N. R.
  2021; 2 (4)
- **Caring for Caregivers** *NEJM Catalyst*
  Wong, V., Rosenbaum, S., Sung, W., Kaplan, R. M., Bott, N., Platchek, T., Milstein, A., Shah, N. R.
  2021
- **Quantifying Parkinson's disease motor severity under uncertainty using MDS-UPDRS videos.** *Medical image analysis*
  Lu, M., Zhao, Q., Poston, K. L., Sullivan, E. V., Pfefferbaum, A., Shahid, M., Katz, M., Kouhsari, L. M., Schulman, K., Milstein, A., Niebles, J. C., Henderson, V. W., Fei-Fei, et al
  2021; 73: 102179
- **Caring for Caregivers: Bridging the Gap Between Family Caregiving Policy and Practice** *NEJM Catalyst: Innovations in Care Delivery*
  Wong, V., Rosenbaum, S., Sung, W., Kaplan, R. M., Bott, N., Platchek, T., Milstein, A., Shah, N. R.
  2021; 2 (4)
- **Assessment of Electronic Health Record Use Between US and Non-US Health Systems.** *JAMA internal medicine*
  Holmgren, A. J., Downing, N. L., Bates, D. W., Shanafelt, T. D., Milstein, A., Sharp, C. D., Cutler, D. M., Huckman, R. S., Schulman, K. A.
  2020
- **Assessing the accuracy of automatic speech recognition for psychotherapy.** *NPJ digital medicine*
  Miner, A. S., Haque, A., Fries, J. A., Fleming, S. L., Wilfley, D. E., Terence Wilson, G., Milstein, A., Jurafsky, D., Arnow, B. A., Stewart Agras, W., Fei-Fei, L., Shah, N. H.
  2020; 3: 82
- **Association Between HEDIS Performance and Primary Care Physician Age, Group Affiliation, Training, and Participation in ACA Exchanges.** *Journal of general internal medicine*
  Glassman, J. R., Hopkins, D. S., Bundorf, M. K., Kaplan, R. M., Ragavan, M. V., Glaseroff, A. n., Milstein, A. n.
  2020
- **Health Care Is Failing the Most Vulnerable Patients: Three Underused Solutions.** *Public health reports (Washington, D.C. : 1974)*
  Rochlin, D. H., Lee, C. M., Scheuter, C. n., Platchek, T. n., Kaplan, R. M., Milstein, A. n.
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  Singh, A. n., Haque, A. n., Alahi, A. n., Yeung, S. n., Guo, M. n., Glassman, J. R., Beninati, W. n., Platchek, T. n., Fei-Fei, L. n., Milstein, A. n.

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- **Effects of Mental Health on the Costs of Care for Chronic Illnesses.** *Psychiatric services (Washington, D.C.)*
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- **Cost impact of sobering centers on national health care spending in the United States.** *Translational behavioral medicine*
  Scheuter, C., Rochlin, D. H., Lee, C., Milstein, A., Kaplan, R. M.
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- **The Implications of "Medicare for All" for US Hospitals** *JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*
  Schulman, K. A., Milstein, A.
  2019; 321 (17): 1661–62
- **Contributions of Health Care to Longevity: A Review of 4 Estimation Methods.** *Annals of family medicine*
  Kaplan, R. M., Milstein, A.
  2019; 17 (3): 267–72
- **Improving the Value of Medical Care for Patients with Back Pain** *PAIN MEDICINE*
  Wood, A., Matula, S. R., Huan, L., Linos, E., Platchek, T., Milstein, A.
  2019; 20 (4): 664–67
- **A computer vision system for deep learning-based detection of patient mobilization activities in the ICU.** *NPJ digital medicine*
  Yeung, S., Rinaldo, F., Jopling, J., Liu, B., Mehra, R., Downing, N. L., Guo, M., Bianconi, G. M., Alahi, A., Lee, J., Campbell, B., Deru, K., Beninati, et al
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- **Stress Disorders and Dementia in the Danish Population** *AMERICAN JOURNAL OF EPIDEMIOLOGY*
  Gradus, J. L., Horvath-Puho, E., Lash, T. L., Ehrenstein, V., Tamang, S., Adler, N. E., Milstein, A., Glymour, M., Henderson, V. W., Sorensen, H. T.
  2019; 188 (3): 493–99
- **Economic Benefit of "Modern" Nonemergency Medical Transportation That Utilizes Digital Transportation Networks** *AMERICAN JOURNAL OF PUBLIC HEALTH*
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- **Systems Delivery Innovation for Alzheimer Disease** *AMERICAN JOURNAL OF GERIATRIC PSYCHIATRY*
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- **Exploring Care Attributes of Nephrologists Ranking Favorably on Measures of Value.** *Journal of the American Society of Nephrology : JASN*
  Brady, B. M., Ragavan, M. V., Simon, M. n., Chertow, G. M., Milstein, A. n.
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- **Making Machine Learning Models Clinically Useful.** *JAMA*
  Shah, N. H., Milstein, A. n., Bagley PhD, S. C.
  2019
- **Perspectives of Health Care Payer Organizations on Cancer Care Delivery Redesign: A National Study.** *Journal of oncology practice*
  Patel, M. I., Moore, D., Bhattacharya, J., Milstein, A., Coker, T. R.
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- **Systems Delivery Innovation for Alzheimer Disease.** *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry*
  Bott, N. T., Sheckter, C. C., Yang, D., Peters, S., Brady, B., Plowman, S., Borson, S., Leff, B., Kaplan, R. M., Platchek, T., Milstein, A.
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- **Social isolation and all-cause mortality: a population-based cohort study in Denmark** *SCIENTIFIC REPORTS*
  Laugesen, K., Baggesen, L., Schmidt, S., Glymour, M., Lasgaard, M., Milstein, A., Sorensen, H., Adler, N. E., Ehrenstein, V.
  2018; 8: 4731
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  Jin, A., Yeung, S., Jopling, J., Krause, J., Azagury, D., Milstein, A., Li Fei-Fei, IEEE
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- **The Association of ICU Acuity With Outcomes of Patients at Low Risk of Dying.** *Critical care medicine*
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  2017
- **Improving the Value of Medical Care for Patients with Back Pain.** *Pain medicine (Malden, Mass.)*
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