

Kaley (Kaleen) Hayes, PharmD, PhD

Assistant Professor
Department of Health Services, Policy, and Practice
Brown University School of Public Health

Curriculum Vitae

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Providence, Rhode Island, USA

EDUCATION

PhD, Epidemiology 2021
Specialization: Pharmacoepidemiology
University of Toronto Dalla Lana School of Public Health, Toronto, Ontario, Canada

Doctor of Pharmacy (PharmD), *Summa cum laude* 2017
University of Pittsburgh School of Pharmacy, Pittsburgh, Pennsylvania, USA

PRIMARY AFFILIATION

Assistant Professor (Research Scholar Track) 2021 – Present
Dept. of Health Services, Policy, and Practice (primary)
Dept. of Epidemiology (secondary)
Brown University, Providence, RI

OTHER AFFILIATIONS

Health Science Specialist 2024 – Present
Providence VA Medical Center
Transformative Health Systems Research to Improve Veteran Equity and Independence
(THRIVE) Center of Innovation
Providence, RI

Adjunct Assistant Professor 2022 – Present
Department of Pharmaceutical Sciences
University of Toronto, Toronto, Canada

Investigator 2021 – Present
Center for Gerontology and Healthcare Research, Brown University, Providence, RI

LICENSURES AND CERTIFICATIONS

Pennsylvania State Board of Pharmacy
Pharmacist (No. RP451466) 2017 – Present
License to Administer Injectables (No. RPI011390) 2017 – Present

RESEARCH

PEER-REVIEWED PUBLISHED OR IN-PRESS ARTICLES

Summary: total (63), first author (27), senior author (5).

Underlined text denotes direct trainee.

- Shgory F, **Hayes KN**, Kim S, Burden AM, Tadrous M, Aggarwal S, Cadarette SM. The rise and fall of raloxifene use for osteoporosis, 1999 – 2022. **Osteoporos Int**. Published online ahead of print, June 11, 2025. PMID: 40498127.
- Abul Y, Harris DA, Chachlani P, **Hayes KN**, Zullo AR, Mor V, Gravenstein S. Incidence of Long COVID diagnoses in 3.6 million US Medicare beneficiaries with COVID-19. Published online ahead of print, **J Gerontol A Biol Med Sci**. Published online ahead of print, May 15, 2025. PMID: 40371440.

3. **Hayes KN**, Sendhil SR, Aggarwal S, Zullo AR, Berry SD, Oganisian A, Adegboye M, Cadarette SM. Real-world differences in denosumab persistence, reinitiation, and switching among cohorts of older adults in Canada and the United States. **J Bone Miner Res Plus**. 2025;9(6):ziaf061. PMID: 40390804. PMCID: PMC12087952.
4. Riester MR, Ryskina KL, White EM, **Hayes KN**, Harris DA, Zullo AR. Approaches to Identify Nursing Home Specialists Using Medicare Claims Data. Published online ahead of print, **Med Care**, Apr 28, 2025. PMID: 40307676.
5. **Hayes KN**, Zullo AR, Berry SD, Oganisian A, Aggarwal S, Adegboye M, Cadarette SM. Osteoporosis medication use over time in the United States and Canada. **Osteoporos Int**. Published online ahead of print, April 2, 2025. PMID: 40169456.
6. Cupp MA, **Hayes KN**, Berry SD, Beaudoin FL, Riester MR, Joshi R, Zullo AR. Opioid Use After Hip Fracture and Subsequent Fracture Outcomes: A Self-Controlled Case Series Design. **Pharmacoepidemiol Drug Saf**. 2025 Feb;34(2):e70118. doi: PMID: 39950251; PMCID: PMC11899599.
7. Tadrous M, Wang KZ, Chaudhry S, Chu C, Clement F, Guertin JR, Law MR, Thompson W, Gomes T, **Hayes KN**. Canadian Trends in Estimated Drug Purchases and Projections: 2024 and 2025. **Can J Health Technol**. 2024;4(12):1-36. <https://doi.org/10.51731/cjht.2024.1049>
 - Feature: **Globe and Mail**. Wider benefits of Ozempic, Wegovy put pressure on Canadian insurers to expand drug coverage. Published January 14, 2025.
8. McConeghy KW, Davidson HE, Canaday DH, Han L, **Hayes KN**, Baier RR, Abul Y, Saade E, Mor V, Gravenstein S. A cluster-randomized nursing home trial of recombinant versus egg-based quadrivalent influenza vaccination. **JAMA Netw Open**. 2025;8(1):e2452677. PMID: 39745702.
9. Deng Y, **Hayes KN**, Zhao Y, Chachlani P, Zullo AR, Djibo DA, McMahonill-Walraven CN, Mor V, Harris DA. Variation in the time to complete the primary COVID-19 vaccine series by race, ethnicity, and geography among older US adults. **Vaccine**. 2024;43(Pt 2):126501. PMID: 39515194.
10. Zullo AR, Riester MR, **Hayes KN**, Zhang Y, Berry SD, Belanger E, Cupp MA, Beaudoin FL. Analgesic Regimens Administered to Older Adults Receiving Skilled Nursing Facility Care Following Hip Fracture: A Proof-of-Concept Federated Analysis. **BMC Geriatr**. 2024;24(1):897. PMID: 39478461; PMCID: PMC11523817.
11. **Hayes KN**, Niznik JD, Gnjjidic D, Tran N, Moriarty F, Coe AB, Zullo AR, Zhang S, Alcusky M, Bennett D, Hartikainen S, Laroche ML, Li, X, Lin, KJ, Lund JL, Sessa M, Shmuel S, Sirois C, Talbot D, Tiihonen M, Wen X, Sawan MJ, Moga DC. Evaluation of real-world evidence to assess health outcomes related to deprescribing medications in older adults: an International Society for Pharmacoepidemiology-endorsed systematic review of methodology. **Am J Epidemiol**. Epub ahead of print Nov 4, 2024. PMID: 39572376.
12. Tadrous M, Aves T, Fahim C, Riad J, Mittmann N, Prieto-Alhambra D, Rivera DR, Chan K, Lix LM, Kent S, Dawoud D, Guertin JR, McDonald T, Round J, Klarenbach S, Stanojevic, S, De Vera MA, Strumpf E, Platt RW, Husein F, Lambert L, **Hayes KN**. Development of a Canadian Guidance for Reporting Real-world Evidence for Regulatory and Health-Technology Assessment (HTA) Decision Making. **J Clin Epidemiol**. 2024;176:111545. PMID: 39322123.
13. Cupp MA, Berry SD, **Hayes KN**, Daiello L, Riester MR, Zullo AR. Cholinesterase Inhibitor Initiation Does Not Increase the Risk of Fall-Related Injury in Older Adults Treated with Beta-blockers: a Self-controlled Case Series Design. **J Gerontol A Biol Sci Med Sci**. 2024;79(11):glae219. PMID: 39215654. PMCID: PMC11500602.
14. **Hayes KN**, Cupp MA, Joshi R, Riester MR, Beaudoin FL, Zullo AR. Differences in opioid prescriptions by race among U.S. older adults with a hip fracture transitioning to community care. **J Am Geriatr Soc**. 2024;72(12):3730-3741. PMID: 39257240. PMCID: PMC11637942.
15. Singh T, Smith-Ray R, Ogunkoya E, Shah A, Harris DA, **Hayes KN**, Mor V. Health Equity in COVID-19 Testing among Patients of a Large National Pharmacy Chain. **Front Public Health**. 2024;12:1422914. PMID: 39324167; PMCID: PMC11423355.
16. **Hayes KN**, Oganisian A, Kiel DP. Invited Editorial: Improving the value and interpretation of observational studies comparing treatment effects of osteoporosis medications depends on standardized reporting of methods. **J Bone Miner Res**. 2024;39(7):807-809. PMID: 39068509. PMCID: PMC11301716.

17. Ko D, Lee Y, Kim DH, Shah SJ, **Hayes KN**, Zullo AR, Berry SD. Antiplatelet Use in Nursing Home Residents with Atrial Fibrillation. **JAMA Int Med.** 2024;184(10):1256-1258. PMID: 39133502; PMCID: PMC11320326.
 - Accompanying commentary: Essien UR, Keller MS. Deprescribing Equity-A Research Framework for Older Adults. *JAMA Intern Med.* 2024 Oct 1;184(10):1258-1259. PMID: 39133477.
18. Riester MR, Zhang Y, **Hayes KN**, Beaudoin FL, Zullo AR. Use of electronic health record data to examine administrations of pro re nata analgesics during hip fracture post-acute care. **Pharmacoepidemiol Drug Saf.** 2024;33(6):e5846. PMID: 38825963; PMCID: PMC11149906.
19. Shakya I, Zullo AR, **Hayes KN**, Joshi R, Berry SD. Risk Factors for Urinary Tract Infections among Nursing Home Residents Initiating Sodium-glucose Cotransporter-2 Inhibitors. **J Am Geriatr Soc.** 2024;72(9):2878-2881. PMID: 38850171. PMCID: PMC11368622.
20. Riester MR, Zullo AR, Joshi R, Daiello LA, **Hayes KN**, Ko D, Kim DH, Munshi M, Berry SD. Comparative safety and cardiovascular effectiveness of sodium-glucose cotransporter-2 inhibitors and glucagon-like peptide-1 receptor agonists in nursing homes. **Diabetes Obes Metab.** 2024;26(8):3403-3417. PMID: 38779879; PMCID: PMC11233240.
21. **Hayes KN**, Cadarette SM, Burden AM. Methodological guidance for the use of real-world data to measure exposure and utilization patterns of osteoporosis medications. **Bone Rep.** 2024;20:10170. PMID: 38145014. PMCID: PMC10733639.
22. Wen KJ, Harris DA, Chachlani P, **Hayes KN**, et al. COVID-19 Vaccines: Moderna And Pfizer-BioNTech Use Varied By Urban, Rural Counties. **Health Affairs.** 2024;43(5):659-665. PMID: 38709973. PMCID: PMC11148879
23. Harris DA, Chachlani P, **Hayes KN**, et al. COVID-19 and influenza vaccine co-administration among older US adults. **Am J Prev Med.** 2024;67(1):67-78. PMID: 38401746; PMCID: PMC11193626.
24. Tat DP, Zullo AR, Mor V, **Hayes KN**. Sliding Scale Insulin Use in Nursing Homes Before and After Onset of the COVID-19 Pandemic. **J Am Med Dir Assoc.** 2024;25(3):459-464. PMID: 38307122. PMCID: PMC10923121.
25. Berry SD, **Hayes KN**, Lee Y, et al. Fall risk and Cardiovascular Outcomes of First-Line Antihypertensive Medications in Nursing Home Residents. **J Am Geriatr Soc.** 2024;72(3):682-692. PMID: 38051600. PMCID: PMC10947930.
26. Zhang T, Zullo AR, **Hayes KN**, Kim DH, Lee Y, Daiello LA, Kiel DP, Berry SD. Use of Diabetes Medications before and after a Heart Failure-Related Hospitalization among Nursing Home Residents. **J Am Med Dir Assoc.** 2024;25(3):454-458. PMID: 37553080; PMCID: PMC10839110.
27. **Hayes KN**, Zhang T, Kim DH, Daiello LA, Lee Y, Kiel DP, Berry SD**, Zullo AR**. Benefits and Harms of Standard versus Reduced-Dose Direct Oral Anticoagulant Therapy for Multimorbid Older Adults with Atrial Fibrillation. **J Am Heart Assoc.** 2023;12(21):e029865. PMID: 37929769; PMCID: PMC10727413.
 - **Drs. Berry and Zullo contributed equally as co-senior authors.
 - Accompanying commentary: Direct Oral Anticoagulants Versus Vitamin K Antagonist in Elderly Patients with Atrial Fibrillation: Sometimes Less Is More, but Sometimes More Is More. **J Am Heart Assoc.** 2023;12:e032127. PMID: 37929746.
 - Risk-Benefit Ratio Might Favor Lower Oral Anticoagulant Doses. **JAMA.** Published online November 22, 2023. doi:10.1001/jama.2023.22931.
 - Feature: **HealthDay** 2023. Bleeding Higher With Standard-Dose DOACs in Nonvalvular A-Fib. Published on November 16, 2023.
 - Feature: **McKnights Long-Term Care News.** Lower anticoagulant dose means less bleeding in older residents with NVAf, study finds. Published on November 9, 2023.
28. Riester MR, Beaudoin FL, Joshi R, **Hayes KN**, Cupp MA, Berry SD, Zullo AR. Evaluation of post-acute care and one-year outcomes among Medicare beneficiaries with hip fractures: a retrospective cohort study. **BMC Med.** 2023;21(1):232. PMID: 37400841; PMCID: PMC10318833.
29. **Hayes KN**, Harris DA, Zullo AR, Djibo DA, Smith-Ray RL, Taitel MS, Singh TG, McMahonill-Walraven C, Chachlani, P, Wen KJ, McCarthy EP, Gravenstein S, McCurdy S, Baird KE, Moran D, Fenson D, Deng Y, and Mor V. Data Resource Profile: COVID VAXines Effects on the Aged (COVVAXAGE). **IJPS.** 2023. 8(6). PMID: 38425722; PMCID: PMC10900297.

30. **Hayes KN**, **Harris DA**, Zullo AR, Chachlani P, Wen KJ, Smith-Ray RL, Djibo DA, McCarthy EP, Pralea A, Singh TG, McMahonill-Walraven CN, Taitel MS, Deng Y, Gravenstein S, Mor V. Racial and ethnic disparities in COVID-19 booster vaccination among U.S. older adults differ by geographic region and Medicare enrollment. **Front Public Health**. 2023;11:1243958. PMID: 37637796. PMCID: PMC10456997.
 - Feature: **PBS News Hour**. A new COVID vaccine is here, but those at greatest risk may not get it as outreach drops off. Published on Sept 17, 2023.
31. **Harris DA**, **Hayes KN**, Zullo AR, Mor V, Chachlani P, Deng Y, McCarthy EP, Djibo DA, McMahonill-Walraven CN, Gravenstein S. Comparative risks of potential adverse events following COVID-19 mRNA vaccination among older US adults. **JAMA Netw Open**. 2023;6(8):e2326852. PMID: 37531110. PMCID: PMC10398407.
32. Morin SN, Feldman S, Funnell L, Giangregorio L, Kim S, McDonald-Blumer H, Santesso N, Ridout R, Ward W, Ashe MC, Bardai Z, Bartley J, Binkley N, Burrell S, Butt D, Cadarette SM, Cheung AM, Chilibeck P, Dunn S, Falk J, Frame H, Gittings W, **Hayes KN**, et al. Clinical practice guideline for management of osteoporosis and fracture prevention in Canada: 2023 update. **CMAJ**. 2023;195(39):E1333-E1348. PMID: 37816527. PMCID: PMC10610956.
33. Zhang Y, **Hayes KN**, Riester MR, Cupp MA, Lee Y, Zullo AR. Trends in COVID-19-related Medication Use in United States Nursing Homes, 2018-2022. **J Am Med Dir Assoc**. 2023 Aug;24(8):1120-1126.e1. PMID: 37336494. PMCID: PMC10209440.
34. Cupp MA, Beaudoin F, **Hayes KN**, Riester M, Berry S, Joshi R, Zullo AR. 2022. Post-Acute Care Setting after Hip Fracture Hospitalization and Subsequent Opioid Use in Older Adults. **J Am Med Dir Assoc**. 2023;24(7):971-977.e4. PMID: 37080246. PMCID: PMC10293035.
35. **Hayes KN**, Berry SD, Munshi M, Zullo AR. Adoption of sodium–glucose cotransporter 2 inhibitors among prescribers caring for nursing home residents. **J Am Geriatr Soc**. 2023;71(8):2585-2592. PMID: 37078149.
36. Tadrous M, Graill P, **Hayes KN**, Neville H, Houlihand J, Clement F, Guertin JR, Law M, Gomes T. Canadian Trends in Estimated Pharmaceutical Drug Purchases and Projections, 2023. **Can J Health Technol**. 2022;2(11):1-30. <https://doi.org/10.51731/cjht.2022.512>
37. Zullo AR, Riester MR, **Hayes KN**, Munshi M, Berry SD. Comparative Safety of Sulfonylureas among U.S. Nursing Home Residents. **J Am Geriatr Soc**. 2023;71(4):1047-1057. PMID: 36495141.
38. **Hayes KN**, Mor V, Zullo AR. Electronic Health Records to Rapidly Assess Biosimilar Uptake: An Example Using Insulin Glargine in a Large U.S. Nursing Home Cohort. **Front Pharmacol**. 2022; 13:855598. PMID: 35600866; PMCID: PMC9114471.
39. Hofmeister M, Sivakumar A, Clement F, **Hayes KN**, Law M, Guertin JR, Neville HL, Tadrous M. Trends in Canadian Prescription Drug Purchasing: 2001-2020. **J Pharm Policy Prac**. 2022;15(20). PMID: 35300714; PMCID: PMC8928614.
40. **Hayes KN**, Burden AM, Winter EM, Hauser B. Comment on: Paradoxically protective effect of glucocorticoids on bone mass and fragility fracture in a large cohort: a cross-sectional study. **Rheumatol Adv Prac**. 2022;6(2):rkac010. PMCID: PMC9073364.
41. Schneider T, Gomes T, **Hayes KN**, Suda KJ, Tadrous M. Comparisons of Insulin Spending and Price between Canada and the US. **Mayo Clin Proc**. 2022;97(3):573-578. PMID: 35135692.
42. **Hayes KN**, Cheung AM, Brown KA, Kim SA, Juurlink DN, Cadarette SM. Comparative risks of osteoporosis drug holidays following long-term risedronate versus alendronate therapy: a propensity score-matched cohort study. **Ann Intern Med**. 2022;175:335-343. PMID: 35007149.
 - Summary for Patients: Fracture Risk During Osteoporosis Drug Holiday. **Ann Intern Med**. (online only). <https://doi.org/10.7326/P21-0013>.
 - Continuing Medical Education Podcast: Centor RM, **Hayes KN**. Annals On Call - Time for a Bisphosphonate Holiday? **Ann Intern Med**. <https://doi.org/10.7326/A21-0013>.
 - Feature: American College of Physicians (ACP-IM) Internal Medicine Meeting 2022: Recent Articles That Should Influence Practice. Presented April 29, 2022.

43. **Hayes KN**, Baschant U, Hauser B, Burden AM, Winter EM. When to start and stop bone-protecting medication for preventing glucocorticoid induced osteoporosis. **Front Endocrinol**. 2021;12:782118. PMCID: PMC8715727.
44. Tadrous M, Shakeri A, **Hayes KN**, Neville H, Houlihand J, Clement F, Guertin JR, Law M, Gomes T. Canadian Trends in Prescription Drug Expenditures and Projections, 2001-2023. **Can J Health Technol**. 2021;1(11):1-24. <https://doi.org/10.51731/cjht.2021.209>
45. **Hayes KN**, Gomes T, Tadrous M. Greater than the sum: applying daily-dose equivalents to antipsychotic prescription claims. **Front Pharmacol**. 2021;12:709349. PMCID: PMC8378135.
46. Makari J, Dagenais J, Tadrous M, Jennings S, Rahmann I, **Hayes KN**. Hospital pharmacist discharge care is independently associated with reduced risk of hospital readmissions for patients with chronic obstructive pulmonary disease: a propensity score-matched cohort study. **Can Pharm J**. 2022;155(2):101-106. PMID: 35300019. PMCID: PMC8922223
47. **Hayes KN**, Winter EM, Cadarette SM, Burden AM. Duration of bisphosphonate drug holidays in osteoporosis patients: a narrative review of the evidence and considerations for decision-making. **J Clin Med**. 2021;10(5):1140. PMCID: PMC7963175.
48. **Hayes KN**, Burkard T, Burden AM, Weiler S, Tadrous M. Global adverse events reported for direct-acting antiviral therapies for the treatment of Hepatitis C: An analysis of the World Health Organization VigiBase. **Eur J Gastro Hep**. 2021;33(1S):e1017-e1021. PMID: PMID: 33883523. PMCID: PMC8734625.
49. Cadarette SM, Maclure M, Delaney JAC, Gagne JJ, Whitaker HJ, **Hayes KN**, Wang SV, Tadrous M, Gagne JJ, Consiglio GP, Hallas J. Control yourself: ISPE-sponsored guidance for the application of self-controlled study designs in pharmacoepidemiology. **Pharmacoepidemiol Drug Saf**. 2021;30 (6):671-684. PMCID: PMC8251635.
50. **Hayes KN**, Hundal AK, Cadarette SM. Observational study methods used to assess type 2 diabetes pharmacotherapy effects on fracture risk: a scoping review protocol. **JBIM Evidence Synthesis**. 2021;19(11):3129-3141. PMID: 34054037.
51. Shakeri A, **Hayes KN**, Gomes T, Tadrous M. Comparison of public and private payments for direct-acting antivirals (DAAs) across Canada. **Can Liv J**. 2021;4(4):429-9.
52. Hundal AK, Watterson TL, **Hayes KN**. Addressing challenges of precepting student pharmacists enrolled in remote research advanced pharmacy practice experiences. **Am J Pharm Educ**. 2021; 85(5):8311. PMID: 34283730.
53. **Hayes KN**, He N, Brown KA, Kim SM, Cheung AM, Juurlink DN, Cadarette SM. Over half of seniors who start oral bisphosphonate therapy are exposed for 3 or more years: novel rolling window approach and patterns of use. **Osteoporos Int**. 2021;32(7):1413-20. PMID: 33415374.
54. **Hayes KN**, Giannakeas V, Wong AKO. Bisphosphonate use is protective of radiographic knee osteoarthritis progression among those with low disease severity and being non-overweight: data from The Osteoarthritis Initiative. **J Bone Miner Res**. 2020;35(12):2318-26. PMID: 33378555.
55. **Hayes KN**, Giannakeas V, Wong AKO. Response to: Challenges to the Possible Use of Bisphosphonates in Early-Stage Osteoarthritis. **J Bone Miner Res**. 2021;36(4):815-816. PMID: 32662919.
56. Kirisci LK, Tarter RE, Vanyukov MM, **Hayes KN**, Reynolds MD. Derivation and assessment of the opioid use disorder severity scale: prediction of health, psychological and social adjustment problems. **Am J Drug Alcohol Abuse**. 2020; 46(6):699-707. PMID: 31967913.
57. **Hayes KN**, Nakhla N, Tadrous M. Further evidence to monitor chronic proton pump inhibitor use. **JAMA Netw Open**. 2019;2(11):e1916184. PMID: 31774516.
58. **Hayes KN**, Pan I, Kunkel AC, McGivney MS, Thorpe CT. Evaluation of targeted HPV vaccination education among undergraduate college students. **J Am Coll Health**. 2019;67(8):781-789. PMID: 30570453.
59. **Hayes KN**, Tadrous M. The Name Game: A call for change of psychopharmacological nomenclature in clinical practice. **BMJ Opinion**. Nov 12, 2019. <https://bit.ly/2NOg5Jt>

60. **Hayes KN**, Ban JK, Athanasiadis G, Burden AM, Cadarette SM. Time-trends in oral bisphosphonate initiation in Ontario, Canada over 20 years reflect drug policy and healthcare delivery changes. **Osteoporos Int**. 2019;30(11):2311-2319. PMID: 31317249.
61. **Hayes KN**, Bastacky M. Essential statistics for pharmacists: guidance on confounders and regression. Continuing education article and assessment. **The Pennsylvania Pharmacist (Journal of the Pennsylvania Pharmacists Association)**. July/August 2019:29. Available at: papharmacists.com/page/CEHomeStudies.
62. Wong L, **Hayes KN**, Cadarette SM. Bad to the bone: how pharmacists can help minimize drug-induced fracture risk. **Pharm Prac + Business**. 2018;5(10):18-23.
63. **Hayes KN**, Meyer SM. Visual arts programs for health sciences students have unrealized potential for interprofessional education. **Health, Interprofessional Practice & Education**. 2018;3(3).

MANUSCRIPTS CURRENTLY UNDER PEER REVIEW

1. Sendhil SR, Cadarette SM, Aggarwal S, Oganisian A, Zullo AR, Berry SD, Adegboye M, **Hayes KN**. Follow-on osteoporosis therapy after denosumab discontinuation among Medicare beneficiaries. Under review after revisions, **Osteoporos Int**, submitted June 20, 2025.
2. **Hayes KN**, Niznik JD, Gnjjidic D, Moriarty F, Bennett D, Laroche ML, Talbot D, Alcusky M, Sessa M, Coe AB, Sirois C, Zullo AR, Li X, Chalasani SH, Syed J, Sawan M, Moga DC. REporting and Methodological Recommendations for Observational Studies Estimating the effects of Deprescribing medications: the REMROSE-D Guidance. Under review, **Pharmacoepidemiol Drug Saf**, submitted June 4, 2025.
 - Under simultaneous review with the International Society for Pharmacoepidemiology (ISPE) membership for ISPE endorsement.
3. **Hayes KN**, Belanger E, Oganisian A, Joshi R, Wang X, Grove LR, Corcoran KL, Zullo AR. Predictors of a Gabapentinoid–Loop-Diuretic Prescribing Cascade in U.S. Nursing Home Residents. Under review, **J Am Geriatr Soc**, submitted June 10, 2025.
4. Grove LR, Zullo AR, Harris DA, Miranda O, Joshi R, Cupp MA, Beaudoin, Riester MR, **Hayes KN**. Longitudinal Pain Medication Use Among U.S. Older Adults after a Hip Fracture. Under review, **J Am Med Dir Assoc**, submitted June 5, 2025.
5. Zhang S, Zullo AR, Mor V, Grove LR, Oganisian A, **Hayes KN**. Hypertension Treatment, Blood Pressure, and Deprescribing Among U.S. Nursing Home Residents With and Without Dementia Before and After the COVID-19 Pandemic. Under Review, **J Am Med Dir Assoc**, submitted June 10, 2025.
6. Harris DA, Damico A, Mehta HB, Daiello L, Berry SD, Leonard C, Hsu YC, Kiel DP, **Hayes KN**, Riester M, Roberts J, Reich L, Free P, Zullo AR. Identifying observable medication use time for US nursing home residents using Medicare claims: A tutorial. Under review after revisions, **Am J Epidemiol**, submitted June 25, 2025.
7. Spagnuolo MC, Shogry FF, Park S, Bakewell N, **Hayes KN**, Burden AM, Hundal AK, Cadarette SM. Real-world evidence generation methods applied to estimate the safety of chronic medications: scoping review of fracture risk with drugs to treat type 2 diabetes mellitus. Under review, **Osteoporos Int**. Submitted May 15, 2025.
8. Reich LA, Daiello LA, Berry SD, Damico A, Kiel DP, Harris DA, **Hayes KN**, Leonard CE, Hsu YC, Zullo AR. Prevalence and Duration of Potential Drug-Drug Interactions Among US Nursing Home Residents, 2018-2020. Under review, **J Am Geriatr Soc**, submitted May 5, 2025.

INVITED PRESENTATIONS

Summary: national (11), international (7).

NATIONAL INVITED PRESENTATIONS

1. **Hayes KN.** Leveraging linked big data to conduct target trials: tutorial and applied example estimating the effects of herpes zoster vaccination. March 4, 2025. Epidemiology Departmental Seminar (in-person), University of Delaware. (14 faculty and student attendees).
2. **Hayes KN.** Target trial and clone censor weight methods: tutorial and applied examples using linked EHR-Medicare data. February 20, 2025. University of Illinois at Chicago Center for Pharmacoepidemiology & Pharmacoeconomic Research Health Outcomes Departmental Seminar Series (in-person), Chicago, Illinois. (16 faculty and doctoral trainee attendees).
3. **Hayes KN.** Estimating the effect of herpes zoster vaccination on dementia risk: a target trial approach in US nursing homes. Sept 24, 2024. Population Health Sciences Departmental Seminar (in-person), University of Utah. (20 faculty and trainee attendees).
4. **Hayes KN.** Mind the Gap: Implications of Drug Holidays for Fracture Risk. Jun 3, 2024. 2024 Annual Meeting of the Endocrine Society (ENDO 2024) Invited Conference Symposium (in-person), Boston, US. (>300 attendees).
5. **Hayes KN.** Bisphosphonate Therapy Discontinuation: Consideration of Factors Affecting the Fracture Risk during Drug Holidays. Apr 5, 2023. American Society for Bone and Mineral Research Educational Webinar (virtual) (110 member attendees).
6. **Hayes KN, Cadarette SM.** Benefits and Harms of Long-term Osteoporosis Pharmacotherapy: Impact of Treatment Length, Type, Switching, and Holidays. Jan 12, 2023. National Institute on Aging Meeting Presentation (in-person) (2 Program Officers, 14 investigator attendees).
7. **Hayes KN.** Comparative risks of osteoporosis drug holidays following long-term risedronate versus alendronate therapy. Jul 27, 2022. Hebrew SeniorLife Musculoskeletal Group Invited Presentation (virtual). (10 attendees).
8. **Hayes KN.** Comparative Fracture Risk During Osteoporosis Drug Holidays After Long-Term Risedronate Versus Alendronate Therapy. Mar 10, 2022. UCSD Bone Health Patient Interest Group Presentation (virtual). (82 patient attendees).
9. **Hayes KN.** Shorter drug holiday is important to maintain osteoporotic fracture protection during risedronate versus alendronate drug holidays. Feb 8, 2022. Bone Health Extension for Community Health Outcomes (ECHO) group Invited Clinical Presentation (virtual). (78 clinician attendees)
10. **Hayes KN.** Comparative effectiveness of long-term risedronate and alendronate therapy during drug holidays. Nov 23, 2020. Invited Research in Progress Seminar Presented at the Center for Pharmacoepidemiology Research and Training at the University of Pennsylvania School of Medicine.
11. **Hayes KN.** Understanding patterns and estimating effects of long-term bisphosphonate therapy. Nov 2, 2020. Guest Lecture at the Division of Pharmacoepidemiology and Pharmacoeconomics at the Brigham and Women's Hospital and Harvard Medical School (virtual).

INTERNATIONAL INVITED PRESENTATIONS

1. **Hayes KN.** Leveraging linked big data to conduct target trials with clone-censor weighting: tutorial and applied example. Apr 7, 2025. Joint ICES / Clinical, Social, and Administrative Pharmaceutical Sciences Departmental Seminar (virtual), University of Toronto. (12 analyst and student attendees).
2. **Hayes KN.** Estimating the effect of herpes zoster vaccination on dementia risk: a target trial approach in US nursing homes. January 28, 2025. Clinical Epidemiology Departmental Seminar (virtual), Jewish General Hospital/McGill University. (24 researcher attendees).

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3. Tadrous M, **Hayes KN**. Consultation on the Canadian Real-World Evidence Guidance. Dec 2, 2022. Canada's Drug Agency / Health Canada Webinar (virtual) (407 stakeholder attendees).
 4. **Hayes KN**. Real-world patterns of long-term bisphosphonate use and comparative fracture risk of osteoporosis drug holidays. Oct 24, 2022. Australian Institute for Musculoskeletal Science (AIMSS) Annual Research Symposium Keynote Address (virtual) (50 clinician and researcher attendees).
 5. **Hayes KN**. Evidence to Inform Deprescribing: Real-World Example on Anticoagulants and Protocol for Future Guidelines. Jun 24, 2022. Australian Deprescribing Network Presentation. (virtual) (45 attendees).
 6. **Hayes KN**. The Why's and How's of Professional Websites. Apr 27, 2022. International Society for Pharmacoepidemiology Invited Mid-Year Conference Course. (virtual) (80 researcher attendees).
 7. **Hayes KN**. Understanding patterns and estimating effects of long-term bisphosphonate therapy and drug holidays. Mar 12, 2021. University of Waterloo School of Pharmacy Departmental Seminar (virtual) (52 attendees).

SELECTED PEER-REVIEWED ABSTRACTS AND SCIENTIFIC PRESENTATIONS DELIVERED

*Summary: symposia/workshops/courses (6); oral/podium presentations (9); poster presentations (65).
Underlined text denotes direct trainee.*

SYMPOSIA, WORKSHOPS, AND PRE-CONFERENCE COURSES

1. Hilmer S, Steinman M, Reeve E, Mach J, Thurman P, **Hayes KN**. International clinical and translational pharmacology research to inform deprescribing in old age. Symposium, World Congress of Basic and Clinical Pharmacology. July 14, 2026, Melbourne, Australia. (forthcoming)
 - Presentation: **Hayes KN**. REporting and Methodological Recommendations for Observational Studies Estimating the effects of Deprescribing medications: the International Society for Pharmacoepidemiology-endorsed REMROSE-D Guidance.
2. **Hayes KN**, Burden AM, Cadarette SM. Methods to demonstrate the effectiveness of fracture liaison services using real-world data: common pitfalls and solutions. Workshop, Fragility Fracture Annual Meeting, Oct 2025, Porto, Portugal.
3. Harris DA, **Hayes KN**. COVID Vaccination among Medicare Beneficiaries: Findings from an IMPACT Supplement. Grand Rounds, National Institute on Aging (NIA) Imbedded Pragmatic Alzheimer's Disease (AD) and AD-related dementias (ADRD) Clinical Trials (IMPACT) Collaboratory. Dec 2024.
4. **Hayes KN**, Niznik JD, Moga DC, Maciejewski M, Moriarty F, Johnson CM. Methodological guidance for real world evidence to assess the effects of deprescribing. Symposium and Workshop, International Society for Pharmacoepidemiology Annual Meeting, Aug 2024, Berlin, Germany.
5. Shmuel S, Moga D, Niznik JD, Lauffenburger J, Morin L, Gnjjidic D, Li X, **Hayes KN**. Using real-world data and pharmacoepidemiologic methods to advance the science of deprescribing research. [Abstract] Symposium presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Aug 2022, Copenhagen, Denmark.
6. Cadarette SM, Maclure MM, Delaney JAC, Whithaker HJ, **Hayes KN**, Hallas J. Self-Controlled Crossover Observational Pharmacoepidemiologic (SCOPE) Study Designs. [Abstract] Advanced Topics Course, International Society for Pharmacoepidemiology Mid-Year Meeting, Apr 2018, Toronto, Canada.

ORAL/PODIUM PRESENTATIONS

1. **Hayes KN**, Belanger E, Oganisian A, Joshi R, Wang X, Zullo AR. Epidemiology of the Gabapentinoid-Loop Diuretic Prescribing Cascade among US Nursing Home Residents. [Abstract] Oral/podium presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025, Washington, D.C.

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2. Sendhil SR, Cadarette SM, Aggarwal S, Adegboye M, Zullo AR, Berry S, **Hayes KN**. Follow-on therapy after denosumab discontinuation among United States Medicare beneficiaries [Abstract] Oral/podium presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025. Washington, D.C., United States.
 3. McConeghy KW, Harris DA, **Hayes KN**, Han L, Davidson HE, Singh M, Abul Y, Bayer TA, Gravenstein G. Comparative Effectiveness of Two Recombinant Shingles Vaccination Strategies for New Admissions to VA Nursing Homes. [Abstract] [Abstract] Oral/podium presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025. Washington DC, United States.
 4. **Hayes KN**, Harris DA, Zullo AR, Mor V. COVID-19 booster vaccination by race, ethnicity, and frailty among 11.3 million older adults. [Abstract] Oral/podium presentation, American Geriatrics Society Annual Meeting, May 2023, Long Beach, United States.
 5. **Hayes KN**, Cupp MA, Commey A, Joshi R, Beaudoin F, Zullo AR. Differences in opioid use after hip fracture by race and post-acute care use among U.S. older adults. [Abstract] *Pharmacoepidemiol Drug Saf* 2022;31(S2):89. Podium/Oral presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Aug 2022, Copenhagen, Denmark.
 6. **Hayes KN**, Brown KA, Cheung AM, Kim SA, Juurlink DN, Cadarette SM. A shorter drug holiday after 3 or more years of risedronate versus alendronate is important to maintain osteoporotic fracture protection. [Abstract] *JBMR Plus* 2021, in press. Podium/Oral presentation, American Society for Bone and Mineral Research Annual Meeting, Oct 2021, online. **Featured Abstract, opening ceremony.**
 7. **Hayes KN**, Ban J, Athanasiadis G, Burden AM, Cadarette SM. Time trends among new users of osteoporosis drugs over 20 years in Ontario. [Abstract] Podium/oral presentation, Canadian Association for Population Therapeutics Annual Meeting; Oct 2018, Toronto, Canada. **Winner, Top 5 Abstract.**
 8. **Hayes KN**, Cheung AM, Brown KA, Juurlink D, Cadarette SM. Shorter drug holiday after 3 or more years of risedronate versus alendronate is important to maintain osteoporotic fracture protection. *Pharmacoepidemiol Drug Saf* 2021;29(S2):44. Podium/Oral presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Aug 2021, online.
 9. **Hayes KN**, Giannakeas V, Wong AKO. Effects of bisphosphonate use on knee osteoarthritis progression: an analysis of the Osteoarthritis Initiative study. [Abstract] *Pharmacoepidemiol Drug Saf* 2019;28(S2):S22. Podium/Oral presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Aug 2019, Philadelphia, United States.

POSTER PRESENTATIONS (SELECTED)

1. **Hayes KN**, Harris DA, McConeghy KW, Grove L, Joshi R, Chachlani P, Davidson HE, Han L, Free P, Singh M, Bayer TA, Abul Y, Gravenstein S. Effects of recombinant shingles vaccination on incident dementia among newly-admitted US nursing home residents: a target trial emulation. Accepted for poster presentation, IDWeek, Oct 2025, Atlanta, US.
2. Deng Y, Cadarette SM, Oganisian A, Zullo AR, Berry SD, Aggarwal S, Adegboye MA, Hayes KN. Strategies to Define Long-Term Bisphosphonate Use in Observational Studies Using Claims Data. Accepted for poster presentation, American Society for Bone and Mineral Research Annual Meeting, September 2025, Seattle, US.
3. **Hayes KN**, Raj R, Aggarwal S, Clemens K, Cadarette SM. Initial persistence with teriparatide and romosozumab in Ontario, Canada [abstract]. Accepted for poster presentation, American Society for Bone and Mineral Research Annual Meeting, Sept2025, Seattle, US.
4. Leung M, **Hayes KN**, Aggarwal S, Cadarette SM. Trajectories of osteoporosis pharmacotherapy among treatment naïve older females initiating denosumab. Accepted for poster presentation, American Society for Bone and Mineral Research Annual Meeting, Sept 2025, Seattle, US.
5. Deng Y, Cadarette SM, Aggarwal S, Adegboye M, **Hayes KN**. Patterns of Long-Term Bisphosphonate Use Among U.S. Medicare Beneficiaries. [Abstract] Poster presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025. Washington, D.C., United States.

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6. Stettenbauer E, Cadarette SM, Aggarwal SM, Adegboye M, **Hayes KN**. Raloxifene Use Over Time Among U.S. Medicare Beneficiaries. [Abstract] Poster presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025, Washington, D.C., US.
 7. Bhondokhan F, Dow PM, Marshall BDL, **Hayes KN**, Joyce N. Disparities in Nonpharmacologic Chronic Pain Treatments for Older Adults with Alzheimer's disease and Related Dementias. [Abstract] Poster presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025, Washington, D.C.
 8. McConeghy KW, Harris DA, **Hayes KN**, Han L, Davidson HE, Singh M, Abul Y, Bayer TA, Gravenstein G. Incidence of herpes zoster and vaccination rates in VA long-stay nursing home residents. [Abstract] Poster presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025. Washington DC, United States.
 9. Free P, **Hayes KN**, Chachlani P, McConeghy KW, Davidson HE, Han L, Gravenstein, Harris DA. Prescription and non-prescription medication use before and after a herpes zoster diagnosis among nursing home residents in the United States. [Abstract] Poster presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2025. Washington DC, United States.
 10. Bhondokhan F*, Dow PM, Marshall BDL, **Hayes KN**, Joyce N. Disparities in Nonpharmacologic Chronic Pain Treatments for Older Adults with Alzheimer's disease and Related Dementias. [Abstract] Late-Breaking Poster presentation, Society for Epidemiologic Research Annual Meeting, June 2025, Boston, US.
 11. **Hayes KN**, Sendhil SR, Aggarwal S, Zullo AR, Berry SD, Oganisian A, Adegboye M, Cadarette SM. Real-world differences in denosumab persistence, re-start and switching among older adults in Canada versus the United States [Abstract]. Poster presentation, World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases, Rome, Italy. April 2025.
 12. Sendhil SR, Cadarette SM, Aggarwal S, Adegboye M, Zullo AR, Berry S, **Hayes KN**. [Abstract] Poster presentation, American Geriatrics Society Annual Meeting, May 2025, Chicago. *Top-rated abstract, selected for presentation at the Presidential Poster Session.*
 13. Deng Y, Cadarette SM, Aggarwal S, Adegboye M, **Hayes KN**. Poster presentation, American Geriatrics Society Annual Meeting, May 2025, Chicago. *Top-rated abstract, selected for presentation at the Presidential Poster Session.*
 14. **Hayes KN**, Zullo AR, Berry SD, Oganisian A, Aggarwal S, Sendhil SR*, Adegboye M, Cadarette SM. Denosumab discontinuation rates among older adults in the US versus Canada. [Abstract] Poster presentation, American Society for Bone and Mineral Research Annual Meeting, Sept 2024, Toronto, Canada.
 15. **Hayes KN**, Aggarwal S, Sendhil SR, Adegboye M, Cadarette SM. Denosumab data cleaning algorithm to inform exposure measurement and study inclusion: results from two international databases. [Abstract] Poster presentation, International Society for Pharmacoepidemiology Annual Meeting, Aug 2024, Berlin, Germany.
 16. **Hayes KN**, Aggarwal S, Adegboye M, Zullo AR, Berry SD, Oganisian A, Cheung AM, Cadarette SM. Differences in long-term bisphosphonate treatment between older adults in the United States and Canada. [Late-Breaking Abstract] *JBMR Plus*, 2023;38(S2):415. Late-Breaking Poster presentation, American Society for Bone and Mineral Research Annual Meeting, Oct 2023, Vancouver, Canada.
 17. **Hayes KN**, Konstantelos N, Cheung AM, Cadarette SM. Zoledronic acid dosing frequency among older adults in the community. [Abstract] *JBMR Plus*, 2023;38(S2):180. Poster presentation, American Society for Bone and Mineral Research Annual Meeting, Oct 2023, Vancouver, Canada.
 18. **Hayes KN**, Aggarwal S, Cadarette SM. Trends in osteoporosis drug initiation and use among community dwelling older adults. [Abstract] *JBMR Plus*, 2023;38(S2):358. Poster presentation, American Society for Bone and Mineral Research Annual Meeting, Oct 2023, Vancouver, Canada.
 19. **Hayes KN**, Zhang T, Zullo AR, Kim DH, Lee Y, Daiello LA, Kiel DP, Berry SD. Use of Diabetes Medications Before and After a Heart Failure-related Hospitalization Among Nursing Home Residents. [Abstract] Poster presentation, American Geriatrics Society Annual Meeting, May 2023, Long Beach, United States. *Top-rated abstract, selected for presentation at the Presidential Poster Session.*
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20. Harris DA, Zullo AR, Mor V, **Hayes KN**. Comparative safety of BNT162b2 and mRNA-1273 vaccines across frailty subgroups among 6.4 million older adults. [Abstract] Poster presentation, American Geriatrics Society Annual Meeting, May 2023, Long Beach, United States. *Top-rated abstract, selected for presentation at the Presidential Poster Session.*
 21. Tat DP, Zullo AR, Mor V, **Hayes KN**. Sliding Scale Insulin Use in Nursing Homes Before and After Onset of the COVID-19 Pandemic. [Abstract] Poster presentation, American Geriatrics Society Annual Meeting, May 2023, Long Beach, United States.
 22. **Hayes KN**, Zhang T, Berry SD, Zullo AR. Benefits and Harms of Standard versus Reduced-Dose Direct Oral Anticoagulants for Frail Older Adults. [Abstract] Poster presentation, U.S. Deprescribing Research Network Annual Meeting, May 2022, Orlando, United States.
 23. **Hayes KN**, Riester MR, Zhang Y, Beaudoin F, Zullo AR. Administrations of pro re nata (PRN) analgesics among skilled nursing facility residents following a hip fracture. [Abstract] *Pharmacoepidemiol Drug Saf* 2022;31(S2):379. Poster presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Aug 2022, Copenhagen, Denmark.
 24. **Hayes KN**, Daiello LA, Zullo AR, Berry SD. Use of large-scale electronic health record data to examine precise antihypertensive medication exposures immediately before a fall among US nursing home residents. [Abstract] *Pharmacoepidemiol Drug Saf* 2022;31(S2):379. Poster presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Aug 2022, Copenhagen, Denmark.
 25. **Hayes KN**, He N, Brown K, Cheung AM, Juurlink D, He N, Cadarette SM. Almost half of seniors initiating oral bisphosphonate therapy are exposed for 3 or more years — understanding the benefits and harms of therapy is needed. [Abstract] *Pharmacoepidemiol Drug Saf* 2020; 29(S3):196. Poster presentation, International Conference in Pharmacoepidemiology and Therapeutic Risk Management, Sept 2020, online.
 26. **Hayes KN**, Ban J, Athanasiadis G, Burden AM, Cadarette SM. Time trends among new users of osteoporosis drugs over 20 years: considerations for study design. [Abstract] *J Bone Miner Res* 2018;32 (Suppl 1):169. Poster presentation, American Society for Bone and Mineral Research Annual Meeting, Sept 2018, Montréal, Canada.
 27. **Hayes KN**, Pan I, Thorpe CT. Evaluation of targeted HPV vaccination education among undergraduate college students. [Abstract] Poster presentation, American Public Health Association Annual Meeting, Oct 2016, Denver, USA. *Winner, APHA Outstanding Poster Award.*

PRESENTATIONS UNDER REVIEW

1. **Hayes KN**, Sendhil SR, Oganisian A, Zullo AR, Berry SD, Aggarwal S, Adegboye M, Cadarette SM. Fracture risk after denosumab discontinuation by time off-therapy and prior history of oral bisphosphonate use among older adults. Under review as a Late Breaking Abstract for presentation at: American Society for Bone and Mineral Research, Sept 2025, Seattle, US.

NON-PEER REVIEWED PAPERS AND REPORTS

1. Canadian Association for Drugs and Technologies in Health (Methods Authorship Team: Tadrous M, **Hayes KN**, Aves T, Fahim C). Guidance for reporting real-world evidence, version 1.0. May 2023. Available [here](#).
2. **Hayes KN**. Clinical Guideline Update Literature Review: Comparative effectiveness and safety of different sequential osteoporosis treatment regimens. Aug 10, 2020. *Delivered to the Osteoporosis Canada Guideline Update Pharmacotherapy Working Group.*
3. **Hayes KN**, Wong L, Cadarette SM. Clinical Guideline Update Literature Review: Relative effectiveness and safety of denosumab versus bisphosphonates after long-term bisphosphonate therapy. Apr 15, 2019. *Delivered to the Osteoporosis Canada Guideline Update Pharmacotherapy Working Group.*

CURRENT GRANTS AND RESEARCH CONTRACTS

Prescribing Cascades among Nursing Home Residents with ADRD

2024 – 2027

NIA RF1AG089541 (Project Grant – R01-equivalent)

PI: Hayes, Zullo (contact)

Total costs: \$2,238,104

Description: This research will generate new empirical causal evidence on prescribing cascades to guide medication optimization efforts to reduce adverse drug events in nursing home residents with ADRD, thus directly addressing Strategic Goal C of the NIA.

Note: This award was submitted as and is equivalent to an R01 award. The RF1 designation denotes the funding originates from the Congressionally-Directed Medical Research Programs.

Benefits and Harms of Long-term Osteoporosis Pharmacotherapy

2022 – 2026

NIA R01AG078759 (Project Grant)

PI: Hayes (contact), Cadarette

Total costs: \$2,537,664

Description: This research will leverage multinational healthcare data to answer critical gaps in knowledge about the risks and benefits of long-term bisphosphonate (BP) use, drug holidays, osteoporosis drug therapy (ODT) switching on clinical outcomes and adverse events, particularly in groups with limited representation in trials like men and nursing home (NH) residents.

Note: Jointly funded by the NIA, NIH Office of the Director, and NIH Office of Disease Prevention

Characterizing Guardianship in VA: a mixed methods pilot study

2026 - 2028

VHA I21 RD000652 (VA Pilot Grant)

PI: Mills (Role: Co-Investigator)

Total costs: \$382,845

Description: To leverage natural language processing to identify a national sample of Veterans who have been appointed a guardian and conducting interviews with VA staff, Veterans, and guardians about their experiences with the guardianship process.

Estimating the effect of herpes zoster vaccination on dementia risk: a target trial approach in US nursing homes

2024 – 2026

Investigator-Initiated Industry Contract (Sponsor: GlaxoSmithKline)

PI: Hayes, Harris, Gravenstein

Total costs: \$1,734,527

Description: To conduct two parallel target trial emulations using VHA and linked nursing home electronic health record data to estimate the effectiveness of herpes zoster vaccination on subsequent shingles, incidence dementia, and other health outcomes among newly-admitted nursing home residents.

Comparative Effectiveness of Baloxavir versus Oseltamivir for Influenza Outbreak Management in U.S. Nursing Homes

2021 – 2025

Investigator-Initiated Industry Grant (Sponsor: Genentech)

PI: Gravenstein (Role: Subaward PI)

Total costs: \$407,865

Description: A pragmatic, cluster-randomized trial at the nursing home level to assess the rates of facility-level influenza outbreaks and individual-level patient outcomes using linked Medicare data.

COMPLETED GRANTS AND RESEARCH CONTRACTS

NIA AD/ADRD Health Care Systems Research Collaboratory, supplement “Monitoring Medicare Beneficiaries’ Response to COVID Vaccines”

2021 – 2025

NIA U54AG063546-02S7, U54AG063546-02S8

PI: Mor (Role: Co-Investigator)

Total Costs: \$630,528

Description: This project will create a quasi “real time” data base that can be used to monitor the rates of adverse events of the SARS-CoV-2 vaccine older adults who are frail or who have AD/ADRD. The resulting database and proposed analyses will provide the basis for assessing mid to long term safety and efficacy of the different vaccines being distributed for use.

Comparative effectiveness of Recombinant Influenza Vaccine versus Standard Dose Quadrivalent Influenza Vaccine in U.S. Nursing Homes Investigator-Initiated Industry Contract (Sponsor: Sanofi) PI: Gravenstein (Role: Subaward PI) Brown Costs: \$114,724 <u>Description:</u> A pragmatic, cluster-randomized trial of nursing homes to assess the effectiveness of high vs. standard dose influenza vaccinations on facility-level and resident-level outcomes.	2021 – 2024
Use of real-world data to assess the effects of deprescribing medications on clinical outcomes in older adults International Society for Pharmacoepidemiology Manuscript Grant PI: Hayes Total costs: \$9,950 <u>Description:</u> This manuscript award provided analytic support to conduct a systematic review of observational studies of deprescribing and form reporting and methods guidelines for pharmacoepidemiologic research.	2022 – 2024
Safe Cardiometabolic Drug Prescribing to Prevent Injury in Nursing Home Residents NIA RF1AG061221 (Project Grant) PI: Berry (Role: Co-Investigator) Total costs: \$1,682,035 <u>Description:</u> This project identified cardiometabolic drugs with a poor net clinical benefit, defined as drugs that increase the risk of injurious falls and fail to achieve clinical benefit, to improve prescribing in the nursing home setting. <i>Note: This award was submitted as and is equivalent to an R01 award. The RF1 designation denotes the funding originates from the Congressionally-Directed Medical Research Programs.</i>	2019 – 2024
Leveraging new databases to understand medication use in the post-acute care setting among older adults with hip fracture Brown University Office of the Vice President of Research Salomon Research Award PI: Hayes Total costs: \$14,050	2022 – 2024
iGlarLixi versus Complex Insulin Regimens among Nursing Facility Residents with Diabetes Investigator-Initiated Industry Contract (Sponsor: Sanofi) PI: Hayes Total costs: \$50,000 <u>Description:</u> This pilot study examined the uptake of different complex insulin regimens in nursing homes using electronic health record data.	2022 – 2023
Comparative benefits and harms of long-term osteoporosis pharmacotherapy Canadian Institutes of Health Research Project Grant PI: Hayes, Cadarette Total direct costs: \$100,000 <u>Description:</u> This project leveraged universal healthcare data from Ontario, Canada to examine the effects of different long-term sequences of osteoporosis therapies in older adults.	2019 – 2021

PENDING GRANTS AND RESEARCH CONTRACTS

Benefits and Harms of Antihypertensive Management Strategies for Nursing Home Residents with ADRD NIA 1R01AG087210-01A1 (Project Grant Application) PI: Hayes Total Requested Costs: \$2,238,104 Impact Score: 27 (8 th percentile) Status: Just-in-Time Documents Submitted	
Cannabis and Cannabinoid Use among Nursing Home Residents with ADRD IDeA Networks of Biomedical Research Excellence (INBRE) Pilot Project Proposal PI: Harris (Role: Co-Investigator) Total Requested Brown University Subaward Costs: \$39,990 Status: Just-in-Time Documents Submitted	

GRANTS AND RESEARCH CONTRACTS UNDER REVIEW

Improving Safety of Denosumab Discontinuation for Older Adults with Osteoporosis

NIA F31 Proposal

PI: Sendhil (**Role: Sponsor**)

Status: Pending Scientific Review

Bayesian Machine Learning for Complex Treatment Strategies in Longitudinal Electronic Health Records

Patient Centered Outcomes Methods Research Institute (PCORI) Proposal

PI: Hayes, Oganisian (contact)

Status: Pending Scientific Review

Improving Veterans' Medication Safety Through Novel Deployment of Artificial Intelligence and Advanced Causal Inference Methods

VHA Merit Proposal (I01)

PI: McConeghy (**Role: Co-Investigator**)

Status: Pending Scientific Review

Understanding Use of Evidence-Based Psychotherapies in Aging Veterans with PTSD: Who, Where, How, What, Why, and When?

VHA Merit Proposal (I01)

PI: Lee (**Role: Co-Investigator**)

Status: Pending Scientific Review

Optimizing healthcare delivery and identifying novel risk factors for neurological comorbidity among older adults with autism spectrum disorder

NIH Autism Data Science Institute Project Grant (R01-equivalent)

PI: Harris (**Role: Co-Investigator**)

Status: Pending Scientific Review

RESEARCH TRAINING AWARDS AND SCHOLARSHIPS

Advancing Geriatrics Infrastructure and Network Growth (AGING) Initiative Multiple Chronic Conditions Scholars Program	2023 – 2024
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US Deprescribing Research Network Junior Investigator Intensive Program	2022 – 2023
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Canadian Institutes of Health Research Postdoctoral Fellowship 100,000 CAD (NB: Declined to accept faculty position at Brown University) Rank: 1 st of 98 post-PhD applicants (15 funded)	2021
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American Society of Bone and Mineral Research Young Investigator Travel Grant	2021
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Canadian Institutes of Health Research Doctoral Research Award 105,000 CAD (90,000 CAD stipend; 15,000 CAD Research Grant; F31 Equivalent) Rank: 7 th of 520 applicants in Health Sciences Research Stream (66 funded)	2019 – 2021
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Canadian Institutes of Health Research Drug Safety and Effectiveness Cross-Disciplinary Training Program Award (DSECT) 20,000 CAD; Stream 1 Trainee Stipend	2018 – 2020
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International Society for Pharmacoepidemiology Travel Scholarship 1000 USD	2018, 2019, 2021
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Canadian Institutes of Health Research Drug Safety and Effectiveness Cross-Disciplinary Training Program (DSECT) Travel Scholarship 1100 CAD	2018
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University of Pittsburgh Full Tuition Merit Scholarship 94,376 USD	2011 – 2016
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HONORS, DISTINCTIONS, AND LEADERSHIP RECOGNITION

Health in Aging New Investigator Award, American Geriatrics Society	2023
Emerging Leader Award, International Society for Pharmacoepidemiology	2022
Distinguished Alumni Award, Canadian Institutes of Health Research Drug Safety and Effectiveness Cross-Disciplinary Training Program	2022
Outstanding Applicant Award, Ontario Drug Policy Research Network Training Program	2020
Award for Outstanding Research, TEVA Pharmaceuticals 250 USD honorarium	2017
2016 Patient Care Award, APhA-ASP <i>Directed student chapter and co-authored report which served for evaluation</i>	2017
Chapter of the Year, Rho Chi <i>Served on executive board</i>	2017
Program of the Year Award, University of Pittsburgh Student Affairs <i>Co-directed HPV Vaccination Education and Research Initiative for Undergraduates</i>	2016

SERVICE

SERVICE TO THE CENTER, DEPARTMENT, AND UNIVERSITY

Brown University

Founder and Co-Director, Brown School of Public Health Pharmaceutical Research Group	2025 – present
Advisor, Undergraduate Public Health Concentration	2022 – present
Number of advisees to date: 31	
Member, School of Public Health Undergraduate Studies Committee	2024 – present
Member, Health Services Research PhD Program Admissions Committee	2024 – present
Lead, Health Services Research PhD Program Infectious Disease Track	2023 – present
Junior Faculty Rep., Center for Gerontology and Healthcare Research Operations Committee	2023 – 2026
Committee Member, Center for Health System Sustainability Tenure Track Faculty Search	2024
Hired Faculty: Olivier Wouters, PhD	

PEER-REVIEW

Grant Review (Proposals Reviewed)

NIH Aging, Injury, Musculoskeletal, and Rheumatologic Disorders (AIMR) Ad Hoc Reviewer	2024 (14), 2025 (1)
NIH Cardiovascular and Respiratory Diseases (CRD) Study Section Ad Hoc Reviewer	2023 (1)
NIH Pathway to Independence (AGCD1) Study Section Ad Hoc Reviewer	2022 (5), 2023 (6)
PSI Foundation Operating Grant Ad Hoc Reviewer	2022 (1), 2023 (1)

Manuscript Peer Review

American Journal of Epidemiology, American Journal of Gastroenterology, Archives of Osteoporosis, BMJ Open, BONE, Circulation: Cardiovascular Quality and Outcomes, Clinical Pharmacy and Therapeutics, Drugs and Aging, Drugs – Real World Outcomes, Frontiers in Endocrinology, Frontiers in Pharmacology, Health and Interprofessional Practice, Journal of the American Medical Directors Association, JBI Evidence Synthesis, Journal of Bone and Mineral Research, Journal of Clinical Epidemiology, Journal of Clinical Medicine, Journal of Comparative Effectiveness Research, Journal of Pharm Health Services Research, Journal of the American Geriatrics Society, Journal of the American Medical Directors Association, NEJM Evidence, Osteoporosis International, Pharmacoepidemiology and Drug Safety, PLOS One, Research in Social and Administrative Pharmacy, Scientific Reports.

Abstract Reviewer

International Society for Pharmacoepidemiology Annual Meeting

2022 (38), 2023 (24),
2024 (35), 2025 (33)

American Society for Bone and Mineral Research (ASBMR) Annual Meeting

2025 (27)

SERVICE TO PROFESSIONAL ORGANIZATIONS

NIH Long-Term Osteoporosis Therapy (RFA AG-22-018) Investigators' Consortium

2022 – present

Meet with Program officers from NIA/NIAMS and other funded Principal Investigators to disseminate results and develop consensus on observational methods.

International Society for Pharmacoepidemiology (ISPE)

Chair, Geriatric Pharmacoepidemiology Special Interest Group

2024 – 2025

Vice Chair, Geriatric Pharmacoepidemiology Special Interest Group

2023 – 2024

Member, Mid-Year Meeting Planning Committee

2018

Long-term Care Data Cooperative

Mentor Real-World Data Scholars Faculty Training Program

2024 – present

Member, Technical User Advisory Committee

2023 – present

Canada's Drug Agency

Real-World Evidence Guideline Authorship Team

2022 – 2023

Osteoporosis Canada

Member, Guideline Update Pharmacotherapy Working Group

2018 – 2023

TEACHING, ADVISING, AND MENTORING**CLASSROOM COURSES TAUGHT**

Course Code / Title / Type	Session	Role	Course Hours	Enrollment	Average Course Rating / Instructor Rating	Response Rate
PHP 2440 / Introduction to Pharmacoepidemiology / Graduate	Spring '25	Director	36	18	TBD	TBD
	Spring '24	Director	36	16	4.9/5.0 5.0/5.0	68.75%
	Spring '23	Director	36	13	4.9/5.0 5.0/5.0	68.75%

OTHER COURSES TAUGHT**Doctoral Teaching Experience, PHP 2988 S27**

2025 (1)

Enrollee(s): Yalin Deng (2025)

Description: A student enrolled in a PhD program undergoes applied pedagogical instruction by delivering guest lectures and developing assessment materials for a graduate course.**Independent Study, PHP 2980 S4U** (number of students in parentheses)2021 (1), 2022 (2), 2023
(2), 2024 (2)**GUEST LECTURES****University of Delaware Department of Epidemiology**

Pharmacoepidemiology (EPID 634) – Graduate course

“Self-Controlled Study Designs”

2025

University of Toronto

Preparation for Advanced Pharmacy Practice Experiences (PHM330) – PharmD Course

“Critical Appraisal of a Clinical Trial: Design and Bias”

2020

Critical Appraisal (PHM606H) – PharmD course

“Intention-to-treat analysis”

2019, 2020 (2), 2021

“Non-inferiority Trials”

2019, 2020 (2), 2021

Scientific Overviews in Epidemiology (CHL5418H) – MPH course

Tutorial: Conducting meta-analysis in Excel and R

2020

Tutorial: Applying PRISMA and GRADE to a systematic review

2019

Tutorial: Developing the “PICO” for a research question

2019

Introduction to Pharmacoepidemiology (JRH1000) – Graduate course

Advanced Pharmacoepidemiologic Study Designs

2020

Causal Diagrams, Third Variables, and Study Designs

2019

Pharmacology and Epidemiology: Entangled!

2018, 2019

Self-Controlled Study Designs

2018

MENTORING

Summary: PhD Dissertation Chair (2, including ongoing); PhD Academic Advisor (2); PhD Thesis Committee Member (2, including ongoing); Postdoctoral / Faculty Trainees (3); MPH Theses Supervised (8); MPH/ScM Theses Served as Reader or Thesis Committee Member (4); External MSc Thesis Examiner (1); Paid PhD Research Assistantships Supervised (12 semesters).

Postdoctoral / Faculty Trainees

Name	Type (Training Period)	Research Project	Grant Funding	Role	Last Known Position
Yongkang Zhang, PhD	Long-term Care Data Cooperative Data Scholar Faculty Trainee (2024 - present)	Identifying Nursing Home Residents with Type 2 Diabetes	U54AG063546-02S6, PI Mor, Co-I Hayes	Faculty Mentor	Assistant Professor (Tenure Track), Weill Cornell Medicine, Cornell University
Oshin Miranda, PharmD, PhD	Postdoctoral Fellow, Brown University School of Public Health (2024 – present)	Comparative performance of different comorbidity and frailty scores to predict fracture among US Medicare beneficiaries with osteoporosis	R01AG078759, PI Hayes	Postdoctoral Fellowship Supervisor	Postdoctoral Fellow (ongoing)
Caitlin Miller Zondlo DPT, PhD, MSCI	Learning Health Systems Training to Improve Disability and Chronic Condition Care (LeaHD) Scientist	Fall Risk Prediction in Newly Enrolled PACE Participants	P30HS029756; PIs Shireman, Resnik	Faculty Methods Mentor	Assistant Professor, Department of Physical Therapy & Rehabilitation Science, University of Montana
Daniel Harris, PhD	Postdoctoral Research Scientist, Brown University School of Public Health (2022 - 2024)	Comparative Safety and Effectiveness of mRNA vaccines for the prevention of COVID-19 among US Medicare Beneficiaries	U54AG063546-02S7, U54AG063546-02S8, PI Mor, Co-I Hayes	Postdoctoral Fellowship Supervisor	Assistant Professor (Tenure Track), University of Delaware Department of Epidemiology

Doctoral-Level Trainees

Name	Type (Training Period)	Research Project	Grant Funding / Awards	Role	Last Known Position
Sirui (Rita) Zhang, BSc, MPH (as of May 24, 2025)	MPH Student, Epidemiology, Brown University School of Public Health (May 2025 – Present)	Multiple	R01AG078759, PI Hayes	PhD Academic Advisor	PhD student - Epidemiology, Brown University School of Public Health (ongoing)
Yalin Deng, PharmD	PhD Student, Health Services Research (RAship 2022 - present) (PhD 2023 - present)	Trends and Effectiveness of Bisphosphonate Drug Holidays and Alternative Therapy in Older US Medicare Beneficiaries	R01AG078759, PI Hayes U54AG063546-02S7, U54AG063546-02S8, PI Mor, Co-I Hayes International Society for Pharmaco- epidemiology Student Scholarship	PhD Research Assistantship Supervisor (7 semesters) Dissertation Committee Chair/Thesis Advisor	PhD Student, Health Services Research, Brown University School of Public Health (ongoing)
Selvam Sendhil, BA	PhD Student, Epidemiology, Brown University School of Public Health (PhD 2024 - present) (RAship 2024 - present)	Fracture Risk after Denosumab Discontinuation	R01AG078759, PI Hayes Joukowsky Summer Award, International Society for Pharmaco- epidemiology Student Scholarship	PhD Research Assistantship Supervisor (4 semesters) Dissertation Committee Chair/Thesis Advisor	PhD Student, Brown University Department of Epidemiology (ongoing)
Elizabeth (Molly) Stettenbauer, MA	PhD Student, Health Services Research, Brown University School of Public Health	Raloxifene Use Over Time Among U.S. Medicare Beneficiaries	R01AG078759, PI Hayes International Society for Pharmaco- epidemiology Student Scholarship	Dissertation Committee Member Volunteer Research Assistantship Supervisor	PhD Student, Brown University Department of Health Services, Policy, and Practice (ongoing)
Jasmine (Nicole) Agostino	PhD Student, Health Services Research, Brown University School of Public Health	Infectious Disease Health Services Research	N/A	Academic Advisor & Track Lead (Infectious Disease Health Services Research)	PhD Student, Health Services Research, Brown University School of Public Health (ongoing)
Fiona Bhondekhan, MSc	PhD Student, Epidemiology (RAship 2023) (PhD 2023 - present)	Persistence to denosumab therapy for osteoporosis	R01AG078759, PI Hayes	PhD Research Assistantship Supervisor (1 semester) Dissertation Committee Member	PhD Student, Brown University Department of Epidemiology (ongoing)

Master's-Level Trainees

Name	Type (Training Period)	Research Project	Grant Funding	Role	Last Known Position
Harry Le	MSc Student, University of Sydney, Australia	Optimising psychotropic medication use in older adults and people living with dementia	N/A	External MSc Thesis Examiner	MSc Student

Name	Type (Training Period)	Research Project	Grant Funding	Role	Last Known Position
Sirui (Rita) Zhang, BSc, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2023-2025)	Blood Pressure and Deprescribing Patterns in Hypertension Treatment Among U.S. Nursing Home Residents With and Without Dementia	U54AG063546-02S6, PI Mor, Co-I Hayes 2025 Gerontology Prize, Brown University School of Public Health 2025 Top MPH Poster Award, Public Health Research Day, Brown University	MPH Thesis Advisor	PhD student - Epidemiology, Brown University School of Public Health (May 2025 -)
Zhaoxiang Ding, ScM	MSc Student, Biostatistics, Brown University School of Public Health (2023-2025)	Marginal Structure Modeling to Evaluate the Effect of Different Bisphosphonate Treatment Durations in Osteoporosis Patients	R01AG078759, PI Hayes	ScM Thesis Reader	Scientist, Eli Lilly Corp (May 2025-)
Qingrong (Rose) Li, BSc MPH	MPH Student, Epidemiology, Brown University School of Public Health (2024-2025)	Use of Diabetes Medications and Long-term Bisphosphonate Use Among Older Adult Medicare Beneficiaries Initiating Oral Bisphosphonates	R01AG078759, PI Hayes	MPH Thesis Advisor	Project Coordinator, University of Southern California School of Pharmacy
Yuna Choi, PharmD	MSc Student, Pharmaceutical Sciences, University of Toronto	Medication Use Patterns for Osteoporosis between 2011 and 2023	R01AG078759, PI Hayes Canadian Institutes of Health Research Master's Award	MSc Thesis Committee Member	MSc Student, Pharmaceutical Sciences, University of Toronto (ongoing)
Freddy Shgory, MSc	MSc Student, Pharmaceutical Sciences, University of Toronto (2022 - 2024)	The rise and fall of raloxifene use for osteoporosis, 1999 - 2022	R01AG078759, PI Hayes	MSc Thesis Committee Member	PhD Student, University of Waterloo School of Pharmacy
Zihan Zhou, ScM	ScM Student, Biostatistics (2022 - 2024)	Marginal Structural Model for Estimating the Causal Effect of Bisphosphonate Duration on Hip Fracture Risk	R01AG078759, PI Hayes	ScM Thesis Reader	PhD Student, Biostatistics, Penn State University
Yifan Shi, ScM	ScM Student, Biostatistics (2023)	Differences in on-time completion of the COVID-19 vaccine series by race and ethnicity among US Medicare beneficiaries	U54AG063546-02S7, U54AG063546-02S8, PI Mor, Co-I Hayes	ScM Research Assistantship Supervisor	Senior Data Scientist, Continental Finance Company
Olivia Lewis, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2023 - 2024)	Patterns of raloxifene initiation and overall use among US Medicare beneficiaries	R01AG078759, PI Hayes	MPH Thesis Advisor	Management & Program Analyst, Centers for Medicare & Medicaid Services
Neelam Ahmed, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2023 - 2024)	Geospatial differences in long-term bisphosphonate use among Medicare beneficiaries	R01AG078759, PI Hayes	MPH Thesis Advisor	PhD Student, Northwestern University Department of Population Health (Health Policy)
Katelle Donkor, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2023 - 2024)	Evaluation of Long-Term Bisphosphonate Medication Use in Older Adults Prior to Long-term Nursing Facility Admissions	R01AG078759, PI Hayes	MPH Thesis Advisor	Research Administrator, Boston University School of Medicine

Name	Type (Training Period)	Research Project	Grant Funding	Role	Last Known Position
Darlene Tat, PharmD, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2022 - 2024)	Sliding Scale Insulin Use in Nursing Homes Before and After Onset of the COVID-19 Pandemic	U54AG063546-02S6, PI Mor, Co-I Hayes Ginsberg	MPH Thesis Advisor	Pharmacy Department Coordinator of Analytics, Impact, and Outcomes, Brown University Health
Laurel Mangelsdorf, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2022 - 2024)	Observational studies of the effects of de- prescribing medications: a systematic review of methods	International Society for Pharmacoepidemiology Manuscript Award Deprescribing, PI Hayes	MPH Thesis Advisor	Epidemiologist, Virginia Department of Health
Abednego Commeey, MPH	MPH Student, Epidemiology, Brown University School of Public Health (2021-2022)	Exploration of racial and ethnic differences in pain management prescriptions among older adults with a hip fracture	R21AG061632, PI Zullo, Co-I Hayes	MPH Thesis Advisor	Business Analyst, World Wide Technology

Undergraduate Trainees

Name	Type (Training Period)	Research Project	Grant Funding / Awards	Role	Last Known Position
Mallory Go, BA	Undergraduate Public Health Concentrator, Brown University (2024 – 2025)	Prevalence of Drug-Drug Interactions among Nursing Home Residents with Dementia	Brown University Ginsberg Summer Research Award	Ginsberg Research Award Summer Research Assistantship Supervisor	MPH Student, Brown University
Angelica Mroczek, BA	Undergraduate Public Health Concentrator, Brown University (2024 – 2025)	Leveraging the United States Core Data for Interoperability Data Elements for Enhanced Health Risk Assessment: An Illustrative Case Study on Atherosclerotic Cardiovascular Disease	2025 Top Undergraduate Public Health Poster Award, Brown University	Undergraduate Thesis Reader	Medical Student, Brown University
Alexander Pralea, BA	Pre-Medicine student, Brown University (2022)	Disparities in COVID-19 vaccine uptake among Medicare beneficiaries	U54AG063546-02S7, U54AG063546-02S8, PI Mor, Co-I Hayes	Ginsberg Research Award Summer Research Assistantship Supervisor	Medical Student, Brown University
Anisha Hundal, BSc	BSc Student, Microbiology, University of Toronto (2020)	Addressing challenges of precepting student pharmacists enrolled in remote research advanced pharmacy practice experiences	Undergraduate Summer Research Program Award, PI Hundal	Summer Research Assistantship Co- Advisor	PhD student, University of Toronto Department of Laboratory Medicine & Pathobiology