APPENDIX A. SEARCH STRATEGIES

MEDLINE

1	Long term care/
2	Exp nursing homes/
3	Exp homes for the aged/
4	((senior* or continuity care or disabled or old age or geriatric* or elder care*) adj2 (lodge* or facility* or home* or residence* or centre* or center*)).mp.
5	Or/1-4
6	Nurses/or nurse administrators/ or nurse clinicians/ or nursing staff/ or licensed practical nurses/ or nursing assistants
7	workload/or shift work schedule/
8	nursing/ or nursing administration research/
9	((((RN or staff* or care or case or nurse* or skill) adj1 mix) or (staffing adj1model* or care model*) or ((nurs* or staff* or patient* or client) adj1 ratio*) or (nursing adj1 delivery systems$1) or (staff* adj1 level*) or (nurs* adj1 (availb* or coverage or presence or hours or role or dose or schedul* or workforce)) or (minute* or hour* or time)) adj1 (patient* or client* or resident*)).ti,ab.
10	OR/6-9
11	5 and 10
12	Limit 11 to English
13	Limit 12 to yr=”2001-current”
14	Limit 12 to yr=”2013 – current”

EMBASE

1	Institutional care/
2	Nursing home patient/
3	Exp nursing homes/
4	Exp homes for the aged/
5	((senior* OR continuity care OR disabled OR old age OR geriatric* OR elder care*) ADJ2 (lodge* OR facility* OR home* OR residence* OR centre* OR center*)).mp.
6	Or/1-5
7	Nurse/or nurse administrator/ or clinical nurse specialist/ or nursing staff/ or nursing assistants/
8	workload/or shift schedule/
9	((RN OR staff* OR care OR case OR nurse* OR skill) ADJ1 mix) OR (staffing ADJ1 model* OR care model*) OR ((nurs* OR staff* OR patient* OR client) ADJ1 ratio*) OR (nursing ADJ1 delivery systems$1) OR (staff* ADJ1 level*) OR (nurs* ADJ1 (availb* OR coverage OR presence OR hours OR role OR dose)) OR (minute* OR hour* OR time) ADJ1 (patient* OR client* OR resident*)
10	OR/7-9
11	6 and 10

12	Limit 11 to English
13	Limit 12 to yr=”2001-current”
14	Limit 12 to yr=”2013-current”

CINAHL

1	MH “long term care”
2	MH “nursing homes”
3	TI ((senior* OR "continuity care" OR disabled OR "old age" OR geriatric* OR "elder care*") N2 (lodge* OR facility* OR home* OR residence* OR centre* OR center*))
4	AB ((senior* OR "continuity care" OR disabled OR "old age" OR geriatric* OR "elder care*") N2 (lodge* OR facility* OR home* OR residence* OR centre* OR center*))
5	S1 OR S2 OR S3 OR S4
6	(MH "Nurses") OR (MH "clinical nurse specialists") OR (MH “practical nurses") OR "nursing assistants"
7	MH “workload”
8	MH nursing administration research
9	TI ((RN OR staff* OR care OR case OR nurse* OR skill) N1 mix) OR ("staffing” N1 “model*" OR "care model*") OR ((nurs* OR staff* OR patient* OR client) N1 ratio*) OR (nursing N1 "delivery systems*1") OR (staff* N1 level*) OR (nurs* N1 (availb* OR coverage OR presence OR hours OR role OR dose)) OR (minute* OR hour* OR time) N1 (patient* OR client* OR resident*)
10	AB ((RN OR staff* OR care OR case OR nurse* OR skill) N1 mix) OR ("staffing” N1 “model*" OR "care model*") OR ((nurs* OR staff* OR patient* OR client) N1 ratio*) OR (nursing N1 "delivery systems*1") OR (staff* N1 level*) OR (nurs* N1 (availb* OR coverage OR presence OR hours OR role OR dose)) OR (minute* OR hour* OR time) N1 (patient* OR client* OR resident*)
11	S6 OR S7 OR S8 OR S9 OR S10
12	S5 AND S11
13	English (use the LA language field)
14	EM 200101- (limits to Jan 2001 to present)
15	EM 201301- (limits to Jan 2013 to present)

GREY LITERATURE

Site	Date of Access	Terms
Centers for Medicare and Medicaid services www.cms.gov	9-15-2021	“staffing levels”
Centers for Disease Control www.cdc.gov	9-15-2021	“staffing levels” as exact phrase; “nursing home, long term care, community living center” as any of these words

American Association of Retired Persons www.aarp.org	9-14-2021	“staffing levels”
American Health Care Association/National Center for Assisted Living Ahcancal.org	9-14-2021	“staffing levels” “nursing home” and filtered by content type of “AHCA Report”
Office of the Assistant Secretary for Planning and Evaluation https://aspe.hhs.gov/	9-8-2021	“nursing home” and filtered by topic of “Nursing Home and Facilities” “staffing levels” and filtered by topic of “Long-Term Services & Supports, Long-Term Care”
American Nurses Association Nursingworld.org	9-10-2021	"staffing levels"
Leading age https://www.leadingagemn.org/	9-13-2021	“nursing home”
McKnight https://www.mcknight.org/	9-10-2021	“nursing home”
Pioneer Network https://www.pioneernetwork.net/	9-10-2021	“nursing home”
Gerontological Society of America https://www.geron.org/	9-10-2021	“nursing home”
American Association of Colleges of Nursing https://www.aacnnursing.org/	9-10-2021	“nursing home”
Kaiser Family Foundation https://www.kff.org/	9-13-2021	“nursing home” and filtered by content type of “report”

APPENDIX B. EXCLUDED STUDIES

1. Nurse staffing hours is 1 of several factors that affect quality of care for nursing home residents. *AHRQ Research Activities.* 2000(243):13-13. *Ineligible study design.*

2. Staffing level mix affects quality of care in nursing homes. *AHRQ Research Activities.* 2009(343):6-7. *Ineligible publication type.*

3. Nursing homes using more agency staff have lower quality of care. *AHRQ Research Activities.* 2010(358):8-8. *Ineligible publication type.*

4. Staff shortages linked to infection citations in LTC. *Hospital Infection Control & Prevention.* 2011;38(6):68-70. *Ineligible study design.*

5. Nurse-patient ratios in aged care. *Australian nursing journal (July 1993).* 2013;20(7):4. *Ineligible publication type.*

6. LPN Supervision In Long Term Care Facilities. *Iowa Board of Nursing Newsletter.* 2014;33(3):8-8. *Ineligible intervention.*

7. Medication Incidents Occurring in Long-Term Care. *Info Nursing.* 2014;45(3):33-35. *Ineligible setting.*

8. RESIDENTIAL AGED CARE SERVICES and the employment of nursing staff. *Nurses' Paycheck.* 2015;15(1):32-34. *Ineligible publication type.*

9. Akinci F, Krolikowski D. Nurse staffing levels and quality of care in Northeastern Pennsylvania nursing homes. *Applied Nursing Research.* 2005;18(3):130-137. *No eligble outcomes.*

10. Algoso M, Ramjan L, East L, Peters K. An exploration of undergraduate nursing assistant employment in aged care and its value to undergraduate nursing education. *Nurse education today.* 2019;82:32-36. *Ineligible setting.*

11. Álvarez Barbosa F, Pozo-Cruz B, Pozo-Cruz J, Alfonso-Rosa RM, Sañudo Corrales B, Rogers ME. Factors Associated with the Risk of Falls of Nursing Home Residents Aged 80 or Older. *Rehabilitation Nursing.* 2016;41(1):16-25. *Ineligible setting.*

12. Alvarez MR, Kerr BJ, Burtner J, Ledlow G, Fulton LV. Effects of outsourced nursing on quality outcomes in long-term acute-care hospitals. *Journal of Nursing Administration.* 2011;41(3):138-143. *Ineligible intervention.*

13. Alvarez MR, Kerr BJ, Burtner J, Ledlow G, Fulton LV. Use of outsourced nurses in long-term acute care hospitals: Outcomes and leadership preferences. *Journal of Nursing Administration.* 2011;41(2):90-96. *Ineligible setting.*

14. Amuah J, Maxwell C, Cepoiu-Martin M, et al. Resident and facility predictors of hospitalization among older adults with dementia residing in assisted living facilities. *Alzheimer's and Dementia.* 2012;8(4 SUPPL. 1):P429. *Ineligible study design.*

15. Antonova E, Zimmerman D. Scope and severity index: A metric for quantifying nursing home survey deficiency number, scope, and severity adjusted for the state-related measurement Bias. *Journal of the American Medical Directors Association.* 2012;13(2):e7-188. *No eligble outcomes.*

16. Arling G, Abrahamson KA, Cooke V, Lewis T, Kane RL. Facility and market factors affecting transitions from nursing home to community. *Medical Care.* 2011;49(9):790-796. *No eligble outcomes.*

17. Arling G, Mueller C. Nurse staffing and quality: The unanswered question. *Journal of the American Medical Directors Association.* 2014;15(6):376-378. *Ineligible publication type.*

18. Armstrong-Evans M, Moss LA, Craven S, et al. Risk factors for resistance to antimicrobial agents among nursing home residents. *American Journal of Epidemiology.* 2003;157(1):40-47. *Ineligible population.*

19. Arnetz JE, Zhdanova LS, Elsouhag D, Lichtenberg P, Luborsky MR, Arnetz BB. Organizational climate determinants of resident safety culture in nursing homes. *The Gerontologist.* 2011;51(6):739-749. *Ineligible intervention.*

20. Arshad MM, Asmar HA, Rahbar MH, et al. Risk factors for Salmonella Oranienburg outbreak in a nursing home in Michigan. *Journal of the American Geriatrics Society.* 2006;54(4):715-717. *Ineligible study design.*

21. Arts EEA, Landewe-Cleuren SANT, Schaper NC, Vrijhoef HJM. The cost-effectiveness of substituting physicians with diabetes nurse specialists: a randomized controlled trial with 2-year follow-up. *Journal of advanced nursing.* 2012;68(6):1224-1234. *Ineligible setting.*

22. Askerud A, Conder J. Nurses' role in long-term conditions care. *Kai Tiaki Nursing New Zealand.* 2016;22(10):16-17. *Ineligible population.*

23. Backhaus R, Beerens HC, Verbeek H, Hamers JPH, van Rossum E. Rethinking the Staff-Quality Relationship in Nursing Homes. *Journal of Nutrition, Health and Aging.* 2018;22(6):634-638. *Ineligible study design.*

24. Baltiter T, Hilou M. Home nursing-home administration of oral chemotherapy. *International Journal of Gynecological Cancer.* 2012;22(SUPPL. 3):E971-E972. *Ineligible publication type.*

25. Barker KN, Flynn EA, Pepper GA, Bates DW, Mikeal RL. Medication errors observed in 36 health care facilities. *Archives of internal medicine.* 2002;162(16):1897-1903. *Ineligible intervention.*

26. Barry T, Brannon D, Mor V. Nurse aide empowerment strategies and staff stability: Effects on nursing home resident outcomes. *Gerontologist.* 2005;45(3):309-317. *No data 2000 or later.*

27. Bates-Jensen BM, Schnelle JF, Alessi CA, Al-Samarrai NR, Levy-Storms L. The effects of staffing on in-bed times of nursing home residents. *Journal of the American Geriatrics Society.* 2004;52(6):931-938. *No eligble outcomes.*

28. Berlowitz DR, Rosen AK, Wang F, et al. Purchasing or providing nursing home care: can quality of care data provide guidance. *Journal of the American Geriatrics Society.* 2005;53(4):603-608. *No data 2000 or later.*

29. Bernard B, Unroe KT, Callahan CM, Stump TE, Tu W. Variation in Hospice Services by Location of Care: Nursing Home Versus Assisted Living Facility Versus Home. *Journal of the American Geriatrics Society.* 2017;65(7):1490-1496. *Ineligible intervention.*

30. Bertrand RM, Porchak TL, Moore TJ, et al. The nursing home dining assistant program: a demonstration project. *Journal of gerontological nursing.* 2011;37(2):34-43. *Ineligible intervention.*

31. Bjarnadottir RI, Herzig CTA, Travers JL, Castle NG, Stone PW. Implementation of Electronic Health Records in US Nursing Homes. *CIN: Computers, Informatics, Nursing.* 2017;35(8):417-424. *No eligble outcomes.*

32. Blewett LA, Johnson K, McCarthy T, Lackner T, Brandt B. Improving geriatric transitional care through inter-professional care teams. *Journal of Evaluation in Clinical Practice.* 2010;16(1):57-63. *Ineligible intervention.*

33. Bliss DZ, Zehrer C, Savik K, Smith G, Hedblom E. An economic evaluation of four skin damage prevention regimens in nursing home residents with incontinence: economics of skin damage prevention...including commentary by Fader M. *Journal of Wound, Ostomy & Continence Nursing.* 2007;34(2):143-152. *Ineligible intervention.*

34. Bonner A, Rapp MP, Buri JB, Aigner MJ, Drew S, Phipps J. Nurse practitioner/physician collaborative models of care...Aigner MJ, Drew S, Phipps J. A comparative study of nursing home resident outcomes between care provided by nurse practitioners/physicians versus physicians only. JAMDA 2004;5:16-23. *Journal of the American Medical Directors Association.* 2004;5(3):219-221. *Ineligible study design.*

35. Bowblis JR. Staffing ratios and quality: An analysis of minimum direct care staffing requirements for nursing homes. *Health Services Research.* 2011;46(5):1495-1516. *Ineligible intervention.*

36. Bowblis JR, Applebaum R. How Does Medicaid Reimbursement Impact Nursing Home Quality? The Effects of Small Anticipatory Changes. *Health Services Research.* 2017;52(5):1729-1748. *Ineligible intervention.*

37. Bowblis JR, Meng H, Hyer K. The urban-rural disparity in nursing home quality indicators: The case of facility-acquired contractures. *Health Services Research.* 2013;48(1):47-69. *No eligble outcomes.*

38. Boyd M, Armstrong D, Parker J, et al. Do gerontology nurse specialists make a difference in hospitalization of long-term care residents? Results of a randomized comparison trial. *Journal of the American Geriatrics Society.* 2014;62(10):1962-1967. *Ineligible intervention.*

39. Brady L. Prompted voiding yields results. CNAs are key to the success of a pilot study that reduced urinary incontinence for residents of 1 Illinois facility. *Provider (Washington, DC).* 2009;35(3):41-44. *Ineligible intervention.*

40. Brady L. Focus on caregiving. Prompted voiding yields results: CNAs are key to the success of a pilot study that reduced urinary incontinence for residents of 1 Illinois nursing facility. *Provider.* 2009;35(3):41-44. *Ineligible intervention.*

41. Braun RT, Yun H, Casalino LP, et al. Comparative Performance of Private Equity-Owned US Nursing Homes during the COVID-19 Pandemic. *JAMA Network Open.* 2020;3(10):e2026702. *Ineligible intervention.*

42. Brookhart MA, Stedman M, Avorn J, Mogun H, Solomon DH, Parikh S. Correlations of nursing home characteristics with prescription of osteoporosis medications. *Bone.* 2011;48(5):1164-1168. *Ineligible intervention.*

43. Brown KA, Daneman N, Jones M, et al. The Drivers of Acute and Long-term Care Clostridium difficile Infection Rates: A Retrospective Multilevel Cohort Study of 251 Facilities. *Clinical Infectious Diseases.* 2017;65(8):1282-1288. *Ineligible intervention.*

44. Brownlee MA. The solution to the staffing crisis in LTC may be with the millennial generation [full title below]. *Annals of Long-Term Care.* 2010;18(3):19-20. *No eligble outcomes.*

45. Brühl A, Planer K, Hagel A. Variation of Care Time Between Nursing Units in Classification-Based Nurse-to-Resident Ratios: A Multilevel Analysis. *Inquiry (00469580).* 2018;55:1-9. *Ineligible setting.*

46. Buljac-Samardzic M, Van Woerkom M. Improving quality and safety of care in nursing homes by team support for strengths use: A survey study. *PLoS ONE.* 2018;13(7):e020006. *Ineligible setting.*

47. Burgermaster M, Slattery E, Islam N, Ippolito PR, Seres DS. Regional Comparison of Enteral Nutrition–Related Admission Policies in Skilled Nursing Facilities. *Nutrition in Clinical Practice.* 2016;31(3):342-348. *No eligble outcomes.*

48. Bushnell PT, Bailer AJ, Collins JW, Stayner LT, Park RM. Impact of publicly sponsored interventions on musculoskeletal injury claims in nursing homes. *American Journal of Industrial Medicine.* 2009;52(9):683-697. *No eligble outcomes.*

49. Cai S, Rahman M, Intrator O. Obesity and pressure ulcers among nursing home residents. *Medical Care.* 2013;51(6):478-486. *Ineligible intervention.*

50. Canavan ME, Sipsma HL, Bradley EH, Aldridge Carlson MD. Hospice for nursing home residents: Does ownership type matter? *Journal of Palliative Medicine.* 2013;16(10):1221-1226. *No eligble outcomes.*

51. Carter MW. Factors associated with ambulatory care -- sensitive hospitalizations among nursing home residents. *Journal of Aging & Health.* 2003;15(2):295-331. *No data 2000 or later.*

52. Carter MW, Porell FW. Variations in hospitalization rates among nursing home residents: The role of facility and market attributes. *Gerontologist.* 2003;43(2):175-191. *No data 2000 or later.*

53. Carter MW, Porell FW. Vulnerable populations at risk of potentially avoidable hospitalizations: the case of nursing home residents with Alzheimer's disease. *American journal of Alzheimer's disease and other dementias.* 2005;20(6):349-358. *No data 2000 or later.*

54. Carter MW, Porell FW. Nursing home performance on select publicly reported quality indicators and resident risk of hospitalization: grappling with policy implications. *Journal of Aging & Social Policy.* 2006;18(1):17-39. *No data 2000 or later.*

55. Cassie KM, Cassie WE. Organizational and Individual Conditions Associated With Depressive Symptoms Among Nursing Home Residents Over Time. *Gerontologist.* 2012;52(6):812-821. *Ineligible intervention.*

56. Castle N. Consistent staff assignment in Alzheimer's special care units. *Alzheimer's and Dementia.* 2011;7(4 SUPPL. 1):S292. *Ineligible study design.*

57. Castle N, Hanlon J, Handler S. Increasing antidepressant use in older nursing home patients. *Pharmacoepidemiology and Drug Safety (PDS).* 2009;18(S1):S92. *Ineligible study design.*

58. Castle NG. Nursing homes with persistent deficiency citations for physical restraint use. *Medical care.* 2002;40(10):868-878. *No data 2000 or later.*

59. Castle NG. Nurse Aides' ratings of the resident safety culture in nursing homes. *International Journal for Quality in Health Care.* 2006;18(5):370-376. *Ineligible intervention.*

60. Castle NG. Use of agency staff in nursing homes. *Research in gerontological nursing.* 2009;2(3):192-201. *Ineligible intervention.*

61. Castle NG. Staff assist: a resource to improve nursing home quality and staffing. *The Gerontologist.* 2011;51(5):714-722. *Ineligible intervention.*

62. Castle NG. Consistent Assignment of Nurse Aides: Association With Turnover and Absenteeism. *Journal of Aging and Social Policy.* 2013;25(1):48-64. *Ineligible intervention.*

63. Castle NG, Aiju M, Engberg J. Nurse aide agency staffing and quality of care in nursing homes. *Medical Care Research and Review.* 2008;65(2):232-252. *Ineligible intervention.*

64. Castle NG, Castle NG. Differences in nursing homes with increasing and decreasing use of physical restraints. *Medical Care.* 2000;38(12):1154-1163. *No data 2000 or later.*

65. Castle NG, Engberg J, Men A. Nursing home staff turnover: impact on nursing home compare quality measures. *The Gerontologist.* 2007;47(5):650-661. *No eligble outcomes.*

66. Castle NG, Engberg JB. The influence of agency staffing on quality of care in nursing homes. *Journal of aging & social policy.* 2008;20(4):437-457. *Ineligible intervention.*

67. Castle NG, Hyer K, Harris JA, Engberg J. Nurse Aide Retention in Nursing Homes. *The Gerontologist.* 2020;60(5):885-895. *Ineligible intervention.*

68. Cen X, Li Y, Temkin-Greener H. Nursing Home Staff Turnover and Perceived Patient Safety Culture: Results from a National Survey. *The Gerontologist.* 2020;60(7):1303-1311. *No eligble outcomes.*

69. Chen B-A, Lai F-C, Tsao L-I, Chien H-H, Chen C-F, Jeng C. Decision difficulties of long-term-care facility nurses in transferring residents to the emergency department: A cross-sectional nationwide study. *Journal of advanced nursing.* 2021. *Ineligible setting.*

70. Chen CK, Sloane PD, Eckert JK, et al. How good is assisted living? Findings and implications from an outcomes study. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences.* 2005;60(4):S195-S204. *No data 2000 or later.*

71. Chen MM, Grabowski DC. Intended and unintended consequences of minimum staffing standards for nursing homes. *Health Economics (United Kingdom).* 2015;24(7):822-839. *Ineligible intervention.*

72. Chisholm L, Weech-Maldonado R, Laberge A, Lin F-C, Hyer K. Nursing home quality and financial performance: Does the racial composition of residents matter? *Health Services Research.* 2013;48(6 PART1):2060-2080. *No eligble outcomes.*

73. Corazzini KN, Anderson RA, Mueller C, Thorpe JM, McConnell ES. Licensed practical nurse scope of practice and quality of nursing home care. *Nursing Research.* 2013;62(5):315-324. *Ineligible intervention.*

74. Corazzini KN, Mueller C, Anderson RA, Day L, Hunt-McKinney S, Porter K. PAIN MEDICATION MANAGEMENT in Nursing Homes and Nursing Scope of Practice. *Journal of Gerontological Nursing.* 2013;39(4):40-46. *Ineligible study design.*

75. Corazzini KN, Vogelsmeier A, McConnell ES, et al. Perceptions of Nursing Practice: Capacity for High-Quality Nursing Home Care. *Journal of Nursing Regulation.* 2015;6(3):17-24. *No eligble outcomes.*

76. Crecelius C. Determining the Physician-to-Patient Ratio in Post-Acute/Long-Term Care Using an Economic Model. *Journal of the American Medical Directors Association.* 2017;18(12):1088-1089. *No eligble outcomes.*

77. Cummings GG, Estabrooks CA, Doupe M, Ginsburg L, McGregor MJ, Norton PG. Development and Validation of A Scheduled Shifts Staffing (ASSiST) Measure of Unit-Level Staffing in Nursing Homes. *The Gerontologist.* 2017;57(3):509-516. *Ineligible setting.*

78. Currie LM. Fall and injury prevention. *Annual Review of Nursing Research.* 2006;24:39-74. *Ineligible publication type.*

79. Czarnowski EJ, Hickey EC, Young GJ, Parker VA, Berlowitz DR, Saliba D. The effects of changes in nursing home staffing on pressure ulcer rates. *Journal of the American Medical Directors Association.* 2005;6(1):50-53. *No data 2000 or later.*

80. Daras LC, Vadnais A, Pogue YZ, et al. Nearly 1 in five skilled nursing facilities awarded positive incentives under value-based purchasing. *Health Affairs.* 2021;40(1):146-155. *No data 2000 or later.*

81. Decker FH. Nursing staff and the outcomes of nursing home stays. *Medical Care.* 2006;44(9):812-821. *No data 2000 or later.*

82. Decker FH. Nursing home performance in resident care in the United States: Is it only a matter of for-profit versus not-for-profit? *Health Economics, Policy and Law.* 2008;3(2):115-140. *Ineligible intervention.*

83. Decker FH. The relationship of nursing staff to the hospitalization of nursing home residents. *Research in nursing & health.* 2008;31(3):238-251. *No data 2000 or later.*

84. Degenholtz HB, Kane RA, Kane RL, et al. Predicting nursing facility residents' quality of life using external indicators. *Health Services Research.* 2006;41(2):335-356. *Ineligible intervention.*

85. Del Signore A. RNs More Likely to Spot Medication Discrepancies than LPNs. *Annals of Long Term Care.* 2016;24(1):37-38. *Ineligible study design.*

86. Dellefield ME, Harrington C, Kelly A. Observing How RNs Use Clinical Time in a Nursing Home: A Pilot Study. *Geriatric Nursing.* 2012;33(4):256-263. *No eligble outcomes.*

87. Dill JS, Morgan JC, Konrad TR. Strengthening the long-term care workforce: the influence of the WIN A STEP UP workplace intervention on the turnover of direct care workers. *Journal of Applied Gerontology.* 2010;29(2):196-214. *Ineligible intervention.*

88. Dilles T, Stichele RV, Van Rompaey B, Van Bortel L, Elseviers M. Nurses' practices in pharmacotherapy and their association with educational level. *Journal of Advanced Nursing.* 2010;66(5):1072-1079. *Ineligible setting.*

89. Dixon S, Kaambwa B, Nancarrow S, Martin GP, Bryan S. The relationship between staff skill mix, costs and outcomes in intermediate care services. *BMC health services research.* 2010;10:221. *Ineligible setting.*

90. DuBeau C, Mazor KM, Field TS, et al. Are indwelling catheters truly a quality problem in long-term care? *Journal of the American Geriatrics Society.* 2015;63(SUPPL. 1):S103. *Ineligible publication type.*

91. Dyck MJ. Nursing staffing and resident outcomes in nursing homes: Weight loss and dehydration. *Journal of Nursing Care Quality.* 2007;22(1):59-65. *Ineligible intervention.*

92. e Cordova PB, Johansen ML, Zha P, Prado J, Field V, Cadmus E. Does Public Reporting of Staffing Ratios and Nursing Home Compare Ratings Matter? *Journal of the American Medical Directors Association.* 2021. *No eligble outcomes.*

93. Eakman AM, Havens MD, Ager SJ, et al. Fall prevention in long-term care: an in-house interdisciplinary team approach. *Topics in Geriatric Rehabilitation.* 2002;17(3):29-39. *No data 2000 or later.*

94. Ersek M, Thorpe J, Kim H, Thomasson A, Smith D. Exploring End-of-Life Care in Veterans Affairs Community Living Centers. *Journal of the American Geriatrics Society.* 2015;63(4):644-650. *Ineligible intervention.*

95. Estabrooks CA, Cummings GG, Kang SH, et al. The influence of organizational context on best practice use by care aides in residential long-term care settings. *Journal of the American Medical Directors Association.* 2015;16(6):e1-537. *Ineligible setting.*

96. Evans G. Factors influencing emergency hospital admissions from nursing and residential homes: Positive results from a practice-based audit. *Journal of Evaluation in Clinical Practice.* 2011;17(6):1045-1049. *Ineligible intervention.*

97. Evans S, Redman J. Post Acute Readmissions? Not with your Nurse Practitioner in Charge! *Journal of the American Medical Directors Association.* 2020;21(3):B23-B24. *Ineligible intervention.*

98. Fain KM, Alexander GC, Dore DD, Segal JB, Zullo AR, Salgado C. Frequency and Predictors of Analgesic Prescribing in U.S. Nursing Home Residents with Persistent Pain. *Journal of the American Geriatrics Society.* 2017;65(2):286-293. *No eligble outcomes.*

99. Fashaw SA, Thomas KS, McCreedy E, Mor V. Thirty-Year Trends in Nursing Home Composition and Quality Since the Passage of the Omnibus Reconciliation Act. *Journal of the American Medical Directors Association.* 2020;21(2):233-239. *No eligble outcomes.*

100. Fehnel CR, Lee Y, Wendell LC, Thompson BB, Potter NS, Mor V. Post-Acute Care Data for Predicting Readmission After Ischemic Stroke: A Nationwide Cohort Analysis Using the Minimum Data Set. *Journal of the American Heart Association.* 2015;4(9):e002145-N.PAG. *Ineligible intervention.*

101. Field TS, Gurwitz JH, Avorn J, et al. Risk factors for adverse drug events among nursing home residents. *Archives of Internal Medicine.* 2001;161(13):1629-1684. *No data 2000 or later.*

102. Figueroa JF, Riley K, Zheng J, et al. Association of Nursing Home Ratings on Health Inspections, Quality of Care, and Nurse Staffing with COVID-19 Cases. *JAMA - Journal of the American Medical Association.* 2020;324(11):1103-1105. *Ineligible intervention.*

103. Fike C, Drost J, Oravec M. Assessing the impact of Ohio's STNA staffing ratio changes on long term care quality. *Journal of the American Geriatrics Society.* 2017;65(Supplement 1):S250-S251. *Ineligible publication type.*

104. Fleming AA, Day J, Glanfield L. Registered nurse management of urinary catheters in a rehabilitation and long-term care hospital. *International Journal of Nursing Practice (Wiley-Blackwell).* 2000;6(5):237-246. *Ineligible setting.*

105. Foltz C, Lawrence S, Bieiy N, Gratz N, Paxton H, Swavely D. Supporting Primary Care Patient-Centered Medical Homes with Community Care Teams: Findings from a Pilot Study. *Journal of Clinical Outcomes Management.* 2014;21(8):352-361. *Ineligible intervention.*

106. Foster AD, Lee YS. Staffing subsidies and the quality of care in nursing homes. *Journal of health economics.* 2015;41:133-147. *Ineligible intervention.*

107. Frantz RA, Gardner S, Specht JK, McIntire G. Integration of pressure ulcer treatment protocol into practice: clinical outcomes and care environment attributes. *Outcomes Management for Nursing Practice.* 2001;5(3):112-120. *No data 2000 or later.*

108. Ganz DA, Simmons SF, Schnelle JF. Cost-effectiveness of recommended nurse staffing levels for short-stay skilled nursing facility patients. *BMC Health Services Research.* 2005;5:35. *Ineligible study design.*

109. Gauvin H. The Connecticut Nursing Home Quality Initiative--Part II. *Connecticut medicine.* 2003;67(4):245-246. *Ineligible intervention.*

110. Goldfeld KS, Grabowski DC, Caudry DJ, Mitchell SL. Health insurance status and the care of nursing home residents with advanced dementia. *JAMA Internal Medicine.* 2013;173(22):2047-2053. *Ineligible intervention.*

111. Good H, Riley-Doucet CK, Dunn KS. The Prevalence of Uncontrolled Pain in Long-Term Care. *Journal of Gerontological Nursing.* 2015;41(2):33-41. *Ineligible intervention.*

112. Grabowski DC, Zhang X. Nursing Home Staffing and Quality under the Nursing Home Reform Act. *Gerontologist.* 2004;44(1):13-23. *No data 2000 or later.*

113. Graham C, Bueno EB, Ross L, Harrington C. Assessing the Quality of Nursing Homes in Managed Care Organizations: Integrating LTSS for Dually Eligible Beneficiaries. *Inquiry : a journal of medical care organization, provision and financing.* 2018;55:46958018800090. *Ineligible intervention.*

114. Gruber-Baldini AL, Zimmerman S, Boustani M, Watson LC, Williams CS, Reed PS. Characteristics associated with depression in long-term care residents with dementia. *Gerontologist.* 2005:50-55. *Ineligible intervention.*

115. Hain DJ, Tappen R, Diaz S, Ouslander JG. Characteristics of older adults rehospitalized within 7 and 30 days of discharge: implications for nursing practice. *Journal of gerontological nursing.* 2012;38(8):32-44. *Ineligible intervention.*

116. Hanlon JT, Handler SM, Castle NG. Antidepressant prescribing in US nursing homes between 1996 and 2006 and its relationship to staffing patterns and use of other psychotropic medications. *Journal of the American Medical Directors Association.* 2010;11(5):320-324. *No eligble outcomes.*

117. Harrington C. Nursing counts. CMS study: correlation between staffing and quality...Centers for Medicare and Medicaid Services (CMS). *AJN American Journal of Nursing.* 2002;102(9):65-66. *Ineligible intervention.*

118. Harrington C, Carrillo H, Kang T, Olney B. Nurse staffing and deficiencies in the largest for-profit nursing home chains and chains owned by private equity companies. *Health Services Research.* 2012;47(1 PART 1):106-128. *Ineligible intervention.*

119. Harrington C, Ross L, Kang T. Hidden Owners, Hidden Profits, and Poor Nursing Home Care. *International Journal of Health Services.* 2015;45(4):779-800. *Ineligible intervention.*

120. Harrington C, Woolhandler S, Mullan J, Carrillo H, Himmelstein DU. Does investor ownership of nursing homes compromise the quality of care? *American Journal of Public Health.* 2001;91(9):1452-1455. *No data 2000 or later.*

121. Harrington C, Woolhandler S, Mullan J, Carrillo H, Himmelstein DU. Does investor-ownership of nursing homes compromise the quality of care? *International Journal of Health Services.* 2002;32(2):315-325. *No data 2000 or later.*

122. Harris JA, Engberg J, Castle NG. Obesity and intensive staffing needs of nursing home residents. *Geriatric nursing (New York, NY).* 2018;39(6):696-701. *Ineligible intervention.*

123. Haun CN. Examining the Influence of Proximal Density to Nursing School Location on Quality Outcomes in Nursing Homes: An Expanded Study. *Nursing Economic$.* 2021;39(2):67-89. *Ineligible intervention.*

124. Heeren P, Van de Water G, De Paepe L, Boonen S, Vleugels A, Milisen K. Staffing Levels and the Use of Physical Restraints in Nursing Homes. *Journal of Gerontological Nursing.* 2014;40(12):48-54. *Ineligible setting.*

125. Hendrix TJ, Foreman SE. Optimal long-term care nurse-staffing levels. *Nursing Economic$.* 2001;19(4):164-175. *No data 2000 or later.*

126. Herzig CTA, Stone PW, Larson EL, Castle N, Pogorzelska-Maziarz M, Dick AW. Infection Prevention and Control Programs in US Nursing Homes: Results of a National Survey. *Journal of the American Medical Directors Association.* 2016;17(1):85-88. *Ineligible intervention.*

127. Hickman SE, Unroe KT, Buente B, Nazir A, Sachs GA, Ersek MT. An Interim Analysis of an Advance Care Planning Intervention in the Nursing Home Setting. *Journal of the American Geriatrics Society.* 2016;64(11):2385-2392. *Ineligible intervention.*

128. Hicks LL, Rantz MJ, Petroski GF, Mukamel DB. Nursing home costs and quality of care outcomes. *Nursing Economic$.* 2004;22(4):178-192. *No data 2000 or later.*

129. Hodgkinson B, Haesler EJ, Nay R, O'Donnell MH, McAuliffe LP. Effectiveness of staffing models in residential, subacute, extended aged care settings on patient and staff outcomes. *Cochrane Database of Systematic Reviews.* 2011:N.PAG-N.PAG. *Ineligible study design.*

130. Hofmann MT, Bankes PF, Javed A, Selhat M. Decreasing the incidence of falls in the nursing home in a cost-conscious environment: A pilot study. *Journal of the American Medical Directors Association.* 2003;4(2):95-97. *Ineligible intervention.*

131. Hofmann MT, Love R, Francis MA, Corkery EA, Ogunnubi O. A Multidisciplinary Process to Improve Quality Indicators in a Veterans Affairs Community Living Center. *Journal of the American Medical Directors Association.* 2020;21(3):B15. *Ineligible intervention.*

132. Holtz L, Hickman S, Tegeler M, Sachs G, Unroe K, Maurer H. Improving the quality of care to reduce avoidable hospitalizations of nursing facility residents: The optimistic project. *Journal of Pain and Symptom Management.* 2014;47(2):483-484. *Ineligible intervention.*

133. Horn SD. The business case for nursing in long-term care. *Policy, politics & nursing practice.* 2008;9(2):88-93. *No data 2000 or later.*

134. Horn SD, Bender SA, Ferguson ML, et al. The National Pressure Ulcer Long-Term Care Study: pressure ulcer development in long-term care residents. *Journal of the American Geriatrics Society.* 2004;52(3):359-367. *No data 2000 or later.*

135. Horn SD, Buerhaus P, Bergstrom N, Smout RJ. RN staffing time and outcomes of long-stay nursing home residents: pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care. *The American journal of nursing.* 2005;105(11):58-71. *No data 2000 or later.*

136. Horn SD, Smout RJ, Dorr DA. Cost analysis of nursing home registered nurse staffing times. *Journal of the American Geriatrics Society.* 2005;53(5):840-845. *No data 2000 or later.*

137. Huang SS, Bowblis JR. Managerial Ownership in Nursing Homes: Staffing, Quality, and Financial Performance. *The Gerontologist.* 2018;58(6):1136-1146. *Ineligible intervention.*

138. Huijben-Schoenmakers M, Rademaker A, Scherder E. Increasing therapy time by implementing four interventions from the clinical nursing rehabilitation stroke guideline. *Cerebrovascular Diseases.* 2017;43(Supplement 1):135. *Ineligible intervention.*

139. Hunnicutt JN, Jonggyu B, Alcusky M, et al. Geographic Variation in the Initiation of Commonly Used Opioids and Dosage Strength in United States Nursing Homes. *Medical Care.* 2018;56(10):847-854. *Ineligible intervention.*

140. Hunnicutt JN, Ulbricht CM, Tjia J, Lapane KL. Pain and pharmacologic pain management in long-stay nursing home residents. *PAIN.* 2017;158(6):1091-1099. *Ineligible intervention.*

141. Hunt SR, Corazzini K, Anderson RA. Top nurse-management staffing collapse and care quality in nursing homes. *Journal of Applied Gerontology.* 2014;33(1):51-74. *Ineligible study design.*

142. Hurtado DA, Berkman LF, Buxton OM, Okechukwu CA. Schedule Control and Nursing Home Quality: Exploratory Evidence of a Psychosocial Predictor of Resident Care. *Journal of applied gerontology : the official journal of the Southern Gerontological Society.* 2016;35(2):244-253. *Ineligible intervention.*

143. Hutt E, Frederickson E, Ecord M, Kramer AM. Associations among processes and outcomes of care for Medicare nursing home residents with acute heart failure. *Journal of the American Medical Directors Association.* 2003;4(4):195-199. *No data 2000 or later.*

144. Hye-Young J, Qijuan L, Rahman M, Mor V. Medicare Advantage Enrollees' Use of Nursing Homes: Trends and Nursing Home Characteristics. *American Journal of Managed Care.* 2018;24(8):e249-e256. *No eligble outcomes.*

145. Hyer K, Temple A, Johnson CE. Florida's efforts to improve quality of nursing home care through nurse staffing standards, regulation, and Medicaid reimbursement. *Journal of aging & social policy.* 2009;21(4):318-337. *Ineligible intervention.*

146. Hyer K, Thomas KS, Branch LG, Harman JS, Johnson CE, Weech-Maldonado R. The influence of nurse staffing levels on quality of care in nursing homes. *The Gerontologist.* 2011;51(5):610-616. *No eligble outcomes.*

147. Hyer K, Thomas KS, Johnson CE, Harman JS, Weech-Maldonado R. Do Medicaid Incentive Payments Boost Quality? Florida's Direct Care Staffing Adjustment Program. *Journal of Aging and Social Policy.* 2013;25(1):65-82. *No eligble outcomes.*

148. Ingber MJ, Feng Z, Khatutsky G, et al. Initiative To Reduce Avoidable Hospitalizations Among Nursing Facility Residents Shows Promising Results. *Health affairs (Project Hope).* 2017;36(3):441-450. *Ineligible intervention.*

149. Intrator O, Castle NG, Mor V, Intrator O, Castle NG, Mor V. Facility characteristics associated with hospitalization of nursing home residents: results of a national study. *Medical Care.* 1999;37(3):228-237. *No data 2000 or later.*

150. Intrator O, Zinn J, Mor V. Nursing home characteristics and potentially preventable hospitalizations of long-stay residents. *Journal of the American Geriatrics Society.* 2004;52(10):1730-1736. *No data 2000 or later.*

151. Isaksson U. Factors associated with the prevalence of violent behaviour among residents living in nursing homes. *Journal of Clinical Nursing (Wiley-Blackwell).* 2009;18(7):972-980. *Ineligible population.*

152. Jesdale BM, Mack DS, Forrester SN, Lapane KL. Cancer Pain in Relation to Metropolitan Area Segregation and Nursing Home Racial and Ethnic Composition. *Journal of the American Medical Directors Association.* 2020;21(9):1302-1302. *Ineligible intervention.*

153. Jester DJ, Hyer K, Bowblis JR. Quality Concerns in Nursing Homes That Serve Large Proportions of Residents With Serious Mental Illness. *Gerontologist.* 2020;60(7):1312-1321. *Ineligible intervention.*

154. Jia H, Pei Q, Sullivan CT, et al. Poststroke Rehabilitation and Restorative Care Utilization: A Comparison Between VA Community Living Centers and VA-contracted Community Nursing Homes. *Medical Care.* 2016;54(3):235-242. *Ineligible intervention.*

155. Jogerst GJ, Daly JM, Hartz AJ. State policies and nursing home characteristics associated with rates of resident mistreatment. *Journal of the American Medical Directors Association.* 2008;9(9):648-656. *No eligble outcomes.*

156. Jogerst GJ, Daly JM, Schmuch G, Dawson JD, Peek-Asa C. Iowa Nursing Home Characteristics Associated With Reported Abuse. *Journal of the American Medical Directors Association.* 2006;7(4):203-207. *Ineligible intervention.*

157. Jumaili AA, Doucette WR. A Systems Approach to Identify Factors Influencing Adverse Drug Events in Nursing Homes. *Journal of the American Geriatrics Society.* 2018;66(7):1420-1427. *Ineligible intervention.*

158. Kane RL, Keckhafer G, Flood S, Bershadsky B, Siadaty S. The effect of Evercare on hospital use. *Journal of the American Geriatrics Society.* 2003;51(10):1427-1434. *Ineligible intervention.*

159. Kang H, Khachadourian Y, Perella D, Peritz TM, Feemster KA, Coffin SE. The burden of gastroenteritis outbreaks in long-term care settings in Philadelphia, 2009-2018. *Infection Control and Hospital Epidemiology.* 2020;41(11):1310-1314. *Ineligible population.*

160. Kang-Yi CD, Mandell DS, Mui AC, Castle NG. Interaction effect of Medicaid census and nursing home characteristics on quality of psychosocial care for residents. *Health care management review.* 2011;36(1):47-57. *No eligble outcomes.*

161. Katz PR, Pfeil LA, Evans J, Evans M, Sobel H. Determining the Optimum Physician-to-Resident Ratio in the Nursing Home. *Journal of the American Medical Directors Association.* 2017;18(12):1087-1088. *Ineligible study design.*

162. Keeler H, Baier RR, Kosar C, Culross B, Cramer ME. Examining the Impact of Board-Certified Registered Nurses in Skilled Nursing Facilities Using National and State Quality and Clinical Indicators. *Journal of gerontological nursing.* 2019;45(11):39-45. *Ineligible intervention.*

163. Kelly CM, Morgan JC, Jason KJ. Home care workers: Interstate differences in training requirements and their implications for quality. *Journal of Applied Gerontology.* 2013;32(7):804-832. *Ineligible population.*

164. Kennedy A. Evaluating nursing staff mix in long-term care: a comprehensive framework for decision-makers. *Healthcare quarterly (Toronto, Ont).* 2009;12(4):46-53. *Ineligible setting.*

165. Kim H, Harrington C, Greene WH. Registered nurse staffing mix and quality of care in nursing homes: A longitudinal analysis. *Gerontologist.* 2009;49(1):81-90. *No eligble outcomes.*

166. Kim H, Kovner C, Harrington C, Greene W, Mezey M. A panel data analysis of the relationships of nursing home staffing levels and standards to regulatory deficiencies. *The journals of gerontology Series B, Psychological sciences and social sciences.* 2009;64(2):269-278. *No eligble outcomes.*

167. Kim H, Whall AL. Factors associated with psychotropic drug usage among nursing home residents with dementia. *Nursing Research.* 2006;55(4):252-258. *No eligble outcomes.*

168. Kim Y, Davidson LJ, Wolf GA, Wang S-L, Whitman GR. The impact of staffing on patient outcomes across specialty units. *Journal of Nursing Administration.* 2002;32(12):633-639. *No data 2000 or later.*

169. Kimball CC, Nichols CI, Vose JG, Nunley RM, Stambough JB. Skilled Nursing Facility Star Rating, Patient Outcomes, and Readmission Risk After Total Joint Arthroplasty. *Journal of Arthroplasty.* 2018;33(10):3130-3137. *No eligble outcomes.*

170. King BJ, Mody L, McNamara SE, et al. Comparing Catheter-Associated Urinary Tract Infection Prevention Programs between Veterans Affairs Nursing Homes and Non-Veterans Affairs Nursing Homes. *Infection Control and Hospital Epidemiology.* 2017;38(3):287-293. *No eligble outcomes.*

171. Kinsley M. No pressure: as partners in a pressure ulcer prevention program, nurse leaders and staff aim high and achieve remarkable results at North Shore's Extended Care and Rehabilitation. *Nursing Spectrum -- New York & New Jersey Edition.* 2008;20A(24):18-19. *Ineligible publication type.*

172. Kluger M. Nursing counts. Staff turnover in nursing homes: organizational characteristics were examined. *AJN American Journal of Nursing.* 2006;106(10):71-71. *Ineligible study design.*

173. Konetzka RT, Park J, Ellis R, Abbo E. Malpractice litigation and nursing home quality of care. *Health Services Research.* 2013;48(6 PART1):1920-1938. *No eligble outcomes.*

174. Konetzka RT, Yi D, Norton EC, Kilpatrick KE. Effects of medicare payment changes on nursing home staffing and deficiencies. *Health Services Research.* 2004;39(3):463-488. *No data 2000 or later.*

175. Kovner CT, Harrington C. CMS study: correlation between staffing and quality. *The American journal of nursing.* 2002;102(9):65-66. *No eligble outcomes.*

176. Krishnakurup J, Argento V, Choksey M, Blagodatny M, Skudlarska B, Shukla S. Comparison of fall protocols between 2 skilled nursing facilities. *Journal of the American Geriatrics Society.* 2010;58(SUPPL. 1):S53. *Ineligible publication type.*

177. Lakey SL, Gray SL, Sales AEB, Sullivan J, Hedrick SC. Psychotropic use in community residential care facilities: A prospective cohort study. *The American journal of geriatric pharmacotherapy.* 2006;4(3):227-235. *No data 2000 or later.*

178. Lane SJ, Troyer JL, Dienemann JA, Laditka SB, Blanchette CM. Effects of skilled nursing facility structure and process factors on medication errors during nursing home admission. *Health care management review.* 2014;39(4):340-351. *Ineligible intervention.*

179. Lapane KL, Hughes CM, Lapane KL, Hughes CM. Which organizational characteristics are associated with increased management of depression using antidepressants in US nursing homes? *Medical Care.* 2004;42(10):992-1000. *No eligble outcomes.*

180. Lee HYu, Shin JHy, Harrington C. Comparing the nurse staffing in Korean and U.S. nursing homes. *Nursing outlook.* 2015;63(2):137-143. *No eligble outcomes.*

181. Lee S, Johnson J, Veeder H, Trinh HD, Sanchez-Reilly S. Evaluating impact of direct interdisciplinary team hours of care among hospice-enrolled older adults with terminal illness. *Journal of the American Geriatrics Society.* 2018;66(Supplement 2):S208-S209. *Ineligible publication type.*

182. Lemaitre M, Meret T, Rothan-Tondeur M, et al. Effect of influenza vaccination of nursing home staff on mortality of residents: a cluster-randomized trial. *Journal of the American Geriatrics Society.* 2009;57(9):1580-1586. *Ineligible intervention.*

183. Lerner NB. The relationship between nursing staff levels, skill mix, and deficiencies in Maryland nursing homes. *The health care manager.* 2013;32(2):123-128. *No eligble outcomes.*

184. Li Y, Cen X, Cai X, Greener H. Racial and Ethnic Disparities in COVID-19 Infections and Deaths Across U.S. Nursing Homes. *Journal of the American Geriatrics Society.* 2020;68(11):2454-2461. *Ineligible intervention.*

185. Li Y, Cen X, Temkin-Greener H, Harrington C, Mukamel DB, Cai X. Nurse staffing hours at nursing homes with high concentrations of minority residents, 2001-11. *Health Affairs.* 2015;34(12):2129-2137. *Ineligible intervention.*

186. Li Y, Tang Y, Li Q. Associations between Family Ratings on Experience with Care and Clinical Quality-of-Care Measures for Nursing Home Residents. *Medical Care Research and Review.* 2016;73(1):62-84. *Ineligible intervention.*

187. Li Y, Ye Z, Cai X, Glance LG, Harrington C, Mukamel DB. Satisfaction with massachusetts nursing home care was generally high during 2005-09, with some variability across facilities. *Health Affairs.* 2013;32(8):1416-1425. *No eligble outcomes.*

188. Lichtman JH, Leifheit-Limson E, Wang Y, Goldstein LB. Association between skilled nursing facility quality indicators and hospital readmissions after stroke. *Stroke.* 2016;47(SUPPL. 1). *Ineligible intervention.*

189. Liu L-F, Weng R-H, Wu J-Y. Exploring factors influencing residents' health outcomes in long-term care facilities: 1-year follow-up using latent growth curve model. *Quality of Life Research.* 2014;23(9):2613-2627. *Ineligible setting.*

190. Livingstone IH. Examining the Effects of Professional Non-nursing Staffing on Quality of Care in Nursing Homes. *Examining the Effects of Professional Non-Nursing Staffing on Quality of Care in Nursing Homes.* 2018:1-1. *Ineligible intervention.*

191. Lorentz M, Finnegan B. An investigation of the effects of a nonprofit agency's investigations on quality of care in nursing homes. *Nursing forum.* 2013;48(2):82-88. *Ineligible intervention.*

192. Lucas J, Gerhard T, Chakravarty S, Crystal S, Bowblis J. Antipsychotic use among nursing home residents. *Pharmacoepidemiology and Drug Safety (PDS).* 2009;18(S1):S143. *Ineligible study design.*

193. Ludwin BM, Meeks S. Predictors of antipsychotic medication use in nursing home residents. *American Journal of Geriatric Psychiatry.* 2013;21(3 SUPPL. 1):S117-S118. *Ineligible study design.*

194. Maas ML, Specht JP, Buckwalter KC, Gittler J, Bechen K. Nursing home staffing and training recommendations for promoting older adults' quality of care and life: Part 2. Increasing nurse staffing and training. *Research in gerontological nursing.* 2008;1(2):134-152. *Ineligible study design.*

195. Mangaco-Borja E. The significance of introducing permanent assignments for nursing assistants at a long-term care setting on the incidence rate of facility-acquired pressure ulcers among elderly patients. *Journal of the American College of Certified Wound Specialists.* 2011;3(1):13-15. *Ineligible intervention.*

196. Mansbach WE, Mace RA, Clark KM, Firth IM, Breeden JK. Predicting Off-Label Antipsychotic Medication Use in a Randomly Selected Nursing Home Sample Based on Resident and Facility Characteristics. *Research in Gerontological Nursing.* 2016;9(6):257-266. *Ineligible intervention.*

197. Mason DJ. Contrasts in long-term care [corrected] [published erratum appears in AM J NURS 2009 Mar;109(3):14]. *AJN American Journal of Nursing.* 2009;109(1):50-51. *Ineligible study design.*

198. Mathew R, Young Y, Shrestha S. Factors Associated With Potentially Preventable Hospitalization Among Nursing Home Residents in New York State With Chronic Kidney Disease. *Journal of the American Medical Directors Association.* 2012;13(4):337-343. *Ineligible intervention.*

199. McCarthy EP, Ogarek JA, Loomer L, et al. Hospital Transfer Rates Among US Nursing Home Residents With Advanced Illness Before and After Initiatives to Reduce Hospitalizations. *JAMA Internal Medicine.* 2020;180(3):385-394. *Ineligible intervention.*

200. McConnell ES, Lekan D, Corazzini KN. Assuring the adequacy of staffing of long-term care, strengthening the caregiving workforce, and making long-term care a career destination of choice: from mission impossible to mission critical? *North Carolina medical journal.* 2010;71(2):153-157. *Ineligible study design.*

201. McDonald SM, Wagner LM, Castle NG. Staffing-Related Deficiency Citations in Nursing Homes. *Journal of Aging and Social Policy.* 2013;25(1):83-97. *No eligble outcomes.*

202. McGarry BE, Grabowski DC, Barnett ML. Severe staffing and personal protective equipment shortages faced by nursing homes during the covid-19 pandemic. *Health Affairs.* 2020;39(10):1812-1821. *No eligble outcomes.*

203. McGarry BE, White EM, Resnik LJ, Rahman M, Grabowski DC. Medicare's new patient driven payment model resulted in reductions in therapy staffing in skilled nursing facilities. *Health Affairs.* 2021;40(3):392-399. *No eligble outcomes.*

204. McMullen TL, Resnick B, Hansen JC, Miller N, Rubinstein R. Certified Nurse Aides and Scope of Practice: Clinical Outcomes and Patient Safety. *Journal of gerontological nursing.* 2015;41(12):32-39. *Ineligible intervention.*

205. McNulty CAM, Bowen J, Foy C, et al. Urinary catheterization in care homes for older people: self-reported questionnaire audit of catheter management by care home staff. *The Journal of hospital infection.* 2006;62(1):29-36. *Ineligible setting.*

206. Merrifield N. Care homes in staffing crisis as nurses leave to work in NHS. *Nursing times.* 2015;111(28-29):4. *Ineligible setting.*

207. Miles RW. Hip fracture reduction in northwest Arkansas nursing homes. *Journal of the American Medical Directors Association.* 2008;9(6):449-453. *Ineligible intervention.*

208. Miller EL, Alexander GL. Effects of Staffing and Regional Location on Influenza and Pneumococcal Vaccination Rates in Nursing Home Residents. *Journal of Gerontological Nursing.* 2016;42(2):38-44. *No eligble outcomes.*

209. Miller S, Looze J. Do us nursing homes "build or buy" their palliative care expertise? *Journal of Pain and Symptom Management.* 2012;43(2):339. *Ineligible publication type.*

210. Miller SC, Papandonatos G, Fennell M, Mor V. Facility and county effects on racial differences in nursing home quality indicators. *Social Science & Medicine.* 2006;63(12):3046-3059. *No data 2000 or later.*

211. Min A, Hong HC. Effect of nurse staffing on rehospitalizations and emergency department visits among short-stay nursing home residents: A Cross-sectional study using the US Nursing Home Compare database. *Geriatric nursing (New York, NY).* 2019;40(2):160-165. *Ineligible intervention.*

212. Mitchell SL, Kiely DK, Gillick MR. Nursing home characteristics associated with tube feeding in advanced cognitive impairment. *Journal of the American Geriatrics Society.* 2003;51(1):75-79. *No data 2000 or later.*

213. Mitchell SL, Teno JM, Intrator O, Feng Z, Mor V. Decisions to forgo hospitalization in advanced dementia: a nationwide study. *Journal of the American Geriatrics Society.* 2007;55(3):432-438. *Ineligible intervention.*

214. Mody L, Greene MT, Meddings J, et al. A National Implementation Project to Prevent Catheter-Associated Urinary Tract Infection in Nursing Home Residents. *JAMA Internal Medicine.* 2017;177(8):1154-1162. *Ineligible intervention.*

215. Morgan DJ, Zhan M, Goto M, et al. The Effectiveness of Contact Precautions on Methicillin-Resistant Staphylococcus aureus in Long-term Care Across the United States. *Clinical Infectious Diseases.* 2020;71(7):1676-1683. *Ineligible intervention.*

216. Morley JE. Certified nursing assistants: A key to resident quality of life. *Journal of the American Medical Directors Association.* 2014;15(9):610-612. *Ineligible study design.*

217. Moseley CB, Jones L. Registered nurse staffing and OBRA deficiencies in Nevada nursing facilities. *Journal of gerontological nursing.* 2003;29(3):44-50. *No data 2000 or later.*

218. Mount JK, Svarstad BL. Chronic benzodiazepine use in nursing homes: Effects of federal guidelines, resident mix, and nurse staffing. *Journal of the American Geriatrics Society.* 2001;49(12):1673-1678. *No data 2000 or later.*

219. Mueller C. Nurse staffing in long-term care facilities. *Journal of Nursing Administration.* 2002;32(12):640-647. *Ineligible study design.*

220. Mueller C, Karon SL. ANA nurse sensitive quality indicators for long-term care facilities. *Journal of nursing care quality.* 2004;19(1):39-47. *Ineligible intervention.*

221. Mukamel DB, Kang T, Collier E, Harrington C. The relationship of California's medicaid reimbursement system to nurse staffing levels. *Medical Care.* 2012;50(10):836-842. *No eligble outcomes.*

222. Mukamel DB, Weimer DL, Harrington C, Spector WD, Ladd H, Li Y. The effect of state regulatory stringency on nursing home quality. *Health Services Research.* 2012;47(5):1791-1813. *Ineligible intervention.*

223. Myers S, Castle NG. Mental health care deficiency citations in nursing homes and caregiver staffing. *Administration and Policy in Mental Health and Mental Health Services Research.* 2006;33(2):215-225. *No data 2000 or later.*

224. Nazir A, Abrahamson K. Poise-care: A model of patient-centetred care in a skilled nursing facility. *Journal of the American Geriatrics Society.* 2015;63(SUPPL. 1):S73-S74. *Ineligible intervention.*

225. Needleman J. The Economic Case for Fundamental Nursing Care. *Nursing Leadership (1910-622X).* 2016;29(1):26-36. *Ineligible intervention.*

226. Nelson R. AJN reports. Certified medication aides: do they free up nurses' time? Or do they water down care? *AJN American Journal of Nursing.* 2005;105(9):28-29. *Ineligible study design.*

227. Nelson ST, Flynn L. Relationship between missed care and urinary tract infections in nursing homes. *Geriatric Nursing.* 2015;36(2):126-130. *Ineligible intervention.*

228. Neylon J. Nurse-led management of chronic disease in a residential care setting. *Nursing Older People.* 2015;27(9):22-26. *Ineligible setting.*

229. Ogunneye O, Rothberg M, Gadiraju TV, Stefan M, Slawsky M, Friderici J. The association between nursing home care quality and 30-day readmission rates after hospitalization for heart failure. *Journal of Cardiac Failure.* 2012;18(8 SUPPL. 1):S4. *Ineligible publication type.*

230. Olsho LEW, Spector WD, Williams CS, et al. Evaluation of AHRQ's On-Time Pressure Ulcer Prevention Program: A Facilitator-assisted Clinical Decision Support Intervention for Nursing Homes. *Medical Care.* 2014;52(3):258-266. *Ineligible intervention.*

231. Omotowa OO. Staffing Standards and Care Outcomes in For-Profit and Not-For-Profit Religious-Based Nursing Homes. *Staffing Standards & Care Outcomes in For-Profit & Not-For-Profit Religious-Based Nursing Homes.* 2017:1-1. *Ineligible publication type.*

232. Ong ACL, Sabanathan K, Potter JF, Myint PK. High mortality of older patients admitted to hospital from care homes and insight into potential interventions to reduce hospital admissions from care homes: The Norfolk experience. *Archives of Gerontology and Geriatrics.* 2011;53(3):316-319. *Ineligible setting.*

233. Orth J, Temkin-Greener H, Li Y, Simning A, Zimmerman S. Nursing home residents with dementia experience better end-of-life care and outcomes in nursing homes with Alzheimer's special care units. *Health Services Research.* 2020;55(SUPPL 1):19. *Ineligible publication type.*

234. Pagel PJ, Vollbrecht M, Beyers D, Garcia S, Soryal S, Malone M. Transitions from acute care for elders: A readmission reduction program. *Journal of the American Geriatrics Society.* 2013;61(SUPPL. 1):S59-S60. *Ineligible intervention.*

235. Pakai A, Havasi-Santha E, Mate O, et al. Influence of cognitive function and nurse support on malnutrition risk in nursing home residents. *Nursing open.* 2021. *Ineligible setting.*

236. Park J, Stearns SC. Effects of state minimum staffing standards on nursing home staffing and quality of care. *Health services research.* 2009;44(1):56-78. *Ineligible intervention.*

237. Patterson J. The effects of nurse to patient ratios. *Nursing times.* 2011;107(2):22-25. *Ineligible study design.*

238. Paulus ATG, van Raak A, Keijzer F. Informal and formal caregivers' involvement in nursing home care activities: impact of integrated care. *Journal of Advanced Nursing (Wiley-Blackwell).* 2005;49(4):354-366. *Ineligible setting.*

239. Plotzke M, Teno J, Ng Harrison Z, Patel A. How frequently do skilled visits occur during the last 2 days of life for medicare beneficiaries? *Journal of Pain and Symptom Management.* 2014;47(2):498-499. *Ineligible study design.*

240. Popham C, Orrell M. What matters for people with dementia in care homes? *Aging & mental health.* 2012;16(2):181-188. *Ineligible study design.*

241. Potter DEB, Shaffer T, Correa-De-Araujo R, Rhona Limcangco M, Spector W. Risk factors associated with the occurrence of fractures in U.S. nursing homes: Resident and facility characteristics and prescription medications. *Journal of the American Geriatrics Society.* 2007;55(3):327-333. *No data 2000 or later.*

242. Pradhan R, Weech-Maldonado R, Harman JS, Al-Amin M, Hyer K. Private equity ownership of nursing homes: Implications for quality. *Journal of Health Care Finance.* 2015;42(2). *Ineligible intervention.*

243. Prentice TC, Curley AL, Haas DC. Heart failure 30-day readmission rates are associated with nurse-patient ratios. *Journal of Cardiac Failure.* 2013;19(8 SUPPL. 1):S81. *Ineligible study design.*

244. Priest D. Nursing counts. NPs in nursing homes: an issue of quality. *AJN American Journal of Nursing.* 2004;104(9):71-71. *Ineligible publication type.*

245. Pronych GJ, Brown EJ, Mercer K, Horsch K. Oral health coordinators in long-term care - A pilot study. *Special Care in Dentistry.* 2010;30(2):59-65. *No eligble outcomes.*

246. Prusynski R, Mroz T. Employment of Therapy Assistants and Quality in Skilled Nursing Facilities. *Archives of Physical Medicine and Rehabilitation.* 2020;101(12):e138. *Ineligible publication type.*

247. Putallaz P, Bosshard W, Bula C, Papadimitriou M, Senn L. Nosocomial spread of SARS-CoV-2 in a rehabilitation facility: The silent threat of asymptomatic patients with high viral load? *European Geriatric Medicine.* 2020;11(SUPPL 1):S10. *Ineligible intervention.*

248. Radcliff TA, Liebrecht D, Fish R, McNulty M, Kramer AM, Hutt E. Associations among nurse and certified nursing assistant hours per resident per day and adherence to guidelines for treating nursing home-acquired pneumonia. *Journals of Gerontology - Series A Biological Sciences and Medical Sciences.* 2008;63(10):1105-1111. *No eligble outcomes.*

249. Randolph PK, Scott-Cawiezell J. Developing a statewide medication technician pilot program in nursing homes. *Journal of gerontological nursing.* 2010;36(9):36-44. *Ineligible intervention.*

250. Rantz MJ, Flesner MK, Franklin J, et al. Better Care, Better Quality: Reducing Avoidable Hospitalizations of Nursing Home Residents. *Journal of nursing care quality.* 2015;30(4):290-297. *Ineligible intervention.*

251. Rantz MJ, Flesner MK, Zwygart-Stauffacher M. Improving care in nursing homes using quality measures/indicators and complexity science. *Journal of nursing care quality.* 2010;25(1):5-12. *No eligble outcomes.*

252. Rantz MJ, Hicks L, Grando V, et al. Nursing home quality, cost, staffing, and staff mix. *The Gerontologist.* 2004;44(1):24-38. *No eligble outcomes.*

253. Rantz MJ, Zwygart-Stauffacher M, Hicks L, et al. Randomized Multilevel Intervention to Improve Outcomes of Residents in Nursing Homes in Need of Improvement. *Journal of the American Medical Directors Association.* 2012;13(1):60-68. *Ineligible intervention.*

254. Reid RC, Chappell NL. Staff ratios and resident outcomes in special care units: do activity aides make a difference? *Journal of Applied Gerontology.* 2003;22(1):89-103. *No data 2000 or later.*

255. Ritchie L. Unregulated staff administering medications. *Nursing New Zealand (Wellington, NZ : 1995).* 2012;18(10):30. *Ineligible population.*

256. Rosebush CE, Ramirez M, McGovern PM, et al. Evaluation of the Minnesota Safe Patient Handling Act: Trends in workers' compensation indemnity claims in nursing home workers before and after enactment of the law. *Occupational and Environmental Medicine.* 2021;78(1):22-28. *No eligble outcomes.*

257. Roup BJ, Roche JC, Pass M. Infection control program disparities between acute and long-term care facilities in Maryland. *American Journal of Infection Control.* 2006;34(3):122-127. *No eligble outcomes.*

258. Russell TL, Madsen RW, Flesner M, Rantz MJ. Pain management in nursing homes: what do quality measure scores tell us? *Journal of Gerontological Nursing.* 2010;36(12):49-56. *Ineligible intervention.*

259. Schiamberg LB, Oehmke J, Zhang Z, et al. Physical abuse of older adults in nursing homes: a random sample survey of adults with an elderly family member in a nursing home. *Journal of elder abuse & neglect.* 2012;24(1):65-83. *Ineligible intervention.*

260. Schnelle JF. Determining the relationship between staffing and quality. *The Gerontologist.* 2004;44(1):10-12. *Ineligible publication type.*

261. Schnelle JF, Karuza J, Katz PR. Staffing, quality, and productivity in the nursing home. *Journal of the American Medical Directors Association.* 2013;14(11):784-786. *Ineligible study design.*

262. Schnelle JF, Simmons SF. Individualized feeding assistance care for nursing home residents: Staffing requirements to implement 2 interventions. *Journals of Gerontology - Series A Biological Sciences and Medical Sciences.* 2004;59(9):966-973. *Ineligible intervention.*

263. Schnelle JF, Simmons SF, Schroyer LD, Saraf AA. Determining Nurse Aide Staffing Requirements to Provide Care Based on Resident Workload: A Discrete Event Simulation Model. *Journal of the American Medical Directors Association.* 2016;17(11):970-977. *Ineligible intervention.*

264. Sharkey SS, Hudak S, Horn SD, James B, Howes J. Frontline caregiver daily practices: A comparison study of traditional nursing homes and the green house project sites. *Journal of the American Geriatrics Society.* 2011;59(1):126-131. *No eligble outcomes.*

265. Shaw PA. Nursing assistants and quality nursing home care. *Journal of the American Medical Directors Association.* 2014;15(9):609. *Ineligible publication type.*

266. Shefer A, McKibben L, Bardenheier B, Bratzler D, Roberts H. Characteristics of long-term care facilities associated with standing order programs to deliver influenza and pneumococcal vaccinations to residents in 13 states. *Journal of the American Medical Directors Association.* 2005;6(2):97-104. *Ineligible intervention.*

267. Sheikh F, Elon RD, Katz MJ, Brandt N. COVID-19 Pandemic and Management of Chronic Pain in Nursing Homes. *Journal of the American Medical Directors Association.* 2021;22(3):518-519. *Ineligible study design.*

268. Shin JH. Why Do We Require Registered Nurses in Nursing Homes? Using Longitudinal Hierarchical Linear Modeling. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing.* 2018;50(6):705-713. *Ineligible setting.*

269. Simmons SF, Durkin DW, Rahman AN, Choi L, Beuscher L, Schnelle JF. Resident Characteristics Related to the Lack of Morning Care Provision in Long-term Care. *Gerontologist.* 2013;53(1):151-161. *No eligble outcomes.*

270. Simmons SF, Garcia E, Bates-Jensen BM, Schnelle JF, Harrington C, Cadogan M. Relationship of Nursing Home Staffing to Quality of Care. *Health Services Research.* 2004;39(2):225-250. *No eligble outcomes.*

271. Sloane PD, Burkhart JI. Loving and lamenting the role of medications in long term care. *Journal of the American Medical Directors Association.* 2013;14(6):384-385. *Ineligible study design.*

272. Smith DB, Feng Z, Fennell ML, Zinn JS, Mor V. Separate and unequal: racial segregation and disparities in quality across U.S. nursing homes. *Health Affairs.* 2007;26(5):1448-1458. *Ineligible intervention.*

273. Sofer D. Proposed Regulations for Long-Term Care Omit Nurse Staffing Mandates. *AJN American Journal of Nursing.* 2017;117(2):12-12. *Ineligible publication type.*

274. Stearns SC, Park J, Zimmerman S, Gruber-Baldini AL, Konrad TR, Sloane PD. Determinants and effects of nurse staffing intensity and skill mix in residential care/assisted living settings. *The Gerontologist.* 2007;47(5):662-671. *Ineligible population.*

275. Stephens TK. The Relationship between Nurse Staffing and Quality Outcomes in Georgia Nursing Homes. *Relationship Between Nurse Staffing & Quality Outcomes In Georgia Nursing Homes.* 2018:1-1. *Ineligible publication type.*

276. Stevenson DG. Nursing home consumer complaints and their potential role in assessing quality of care. *Medical Care.* 2005;43(2):102-111. *No eligble outcomes.*

277. Stevenson DG, Bramson JS, Grabowski DC. Nursing Home Ownership Trends and Their Impacts on Quality of Care: A Study Using Detailed Ownership Data From Texas. *Journal of Aging & Social Policy.* 2013;25(1):30-47. *Ineligible intervention.*

278. Stokes JA, Purdie DM, Roberts MS. Factors influencing PRN medication use in nursing homes. *Pharmacy world & science : PWS.* 2004;26(3):148-154. *Ineligible setting.*

279. Stone R. Strengthening Care Staff in the Long-Term Care Sector: International Research Perspectives. *Journal of Applied Gerontology.* 2019;38(11):1515-1517. *Ineligible publication type.*

280. Strumpf NE, Evans LK, Maislin G, Bourbonniere M. Organizational characteristics and restraint use for hospitalized nursing home residents. *Journal of the American Geriatrics Society.* 2003;51(8):1079-1084. *No data 2000 or later.*

281. Svarstad BL, Mount JK, Bigelow W. Variations in the treatment culture of nursing homes and responses to regulations to reduce drug use. *Psychiatric Services.* 2001;52(5):666-672. *No data 2000 or later.*

282. Tchouaket É, Kilpatrick K, Jabbour M. Effectiveness for introducing nurse practitioners in six long-term care facilities in Québec, Canada: A cost-savings analysis. *Nursing Outlook.* 2020;68(5):611-625. *Ineligible setting.*

283. Temkin-Greener H, Mao Y, Ladwig S, McGarry B, Li Y. State variations in regulatory stringency for assisted living communities: Potential implications for service supply, cost, and quality. *Health Services Research.* 2020;55(SUPPL 1):23. *Ineligible setting.*

284. Thomas KS, Mor V, Tyler DA, Hyer K. The relationships among licensed nurse turnover, retention, and rehospitalization of nursing home residents. *The Gerontologist.* 2013;53(2):211-221. *Ineligible intervention.*

285. Thompson DL. Geriatric incontinence: the long-term care challenge. *Urologic Nursing.* 2004;24(4):305-356. *No data 2000 or later.*

286. Tjia J, Briesacher BA, Mazor KM, et al. Variation in nursing home antipsychotic use across psychiatric consultant providers. *Pharmacoepidemiology and Drug Safety.* 2013;22(SUPPL. 1):428-429. *Ineligible study design.*

287. Tjia J, Field TS, Mazor KM, et al. Dementia and risk of adverse warfarin-related events in the nursing home setting. *Pharmacoepidemiology and Drug Safety.* 2011;20(SUPPL. 1):S303. *Ineligible study design.*

288. Tolson D, Jackson GA, Dewar B. Quality of Life and Care in the Nursing Home. *Journal of the American Medical Directors Association.* 2014;15(3):154-157. *Ineligible study design.*

289. Towsley GL, Beck SL, Pepper GA. Predictors of Quality in Rural Nursing Homes Using Standard and Novel Methods. *Research in Gerontological Nursing.* 2013;6(2):116-126. *No eligble outcomes.*

290. Travers JL, Wu B, Agarwal M, et al. Assessment of Coronavirus Disease 2019 Infection and Mortality Rates Among Nursing Homes With Different Proportions of Black Residents. *Journal of the American Medical Directors Association.* 2021;22(4):893. *Ineligible intervention.*

291. Trigilia D, Houle TL, Rosenblum D, Milne CT, Delong S. Reducing pressure ulcer prevalence rates in the long-term acute care Setting. *Ostomy Wound Management.* 2009;55(4):50-59. *Ineligible intervention.*

292. Trompelt J, Sauer O, Sturer A. Enquiries from nursing homes-increasing problems? *Clinical Toxicology.* 2014;52(SUPPL. 1):327. *Ineligible study design.*

293. Troyer JL, Sause W. Association between traditional nursing home quality measures and 2 sources of nursing home complaints. *Health Services Research.* 2013;48(4):1256-1278. *Ineligible intervention.*

294. Tsan L, Davis C, Langberg R, Pierce JR. Quality indicators in the department of veterans affairs nursing home care units: a preliminary assessment. *American Journal of Medical Quality.* 2007;22(5):344-350. *Ineligible intervention.*

295. Tyler DA, Leland N, Miller SC, Lepore M. Effect of increased nursing home hospice use on nursing assistant staffing. *Journal of Palliative Medicine.* 2011;14(11):1236-1239. *Ineligible intervention.*

296. Uchida-Nakakoji M, Stone PW, Schmitt S, Phibbs C, Wang YC. Economic evaluation of registered nurse tenure on nursing home resident outcomes. *Applied nursing research : ANR.* 2016;29:89-95. *Ineligible study design.*

297. Vadnais AJ, Vreeland E, Coomer NM, Feng Z, Ingber MJ. Reducing Transfers among Long-Stay Nursing Facility Residents to Acute Care Settings: Effect of the 2013–2016 Centers for Medicare and Medicaid Services Initiative. *Journal of the American Medical Directors Association.* 2020;21(9):1341-1345. *Ineligible intervention.*

298. Van Der Spek K, Wetzels RB, Smeets CH, et al. Factors associated with appropriate psychotropic drug prescription in nursing home patients with severe dementia. *International Psychogeriatrics.* 2018;30(4):547-556. *Ineligible population.*

299. Vig EK, Gessert CE, Haller IV. What is the true association between nursing home location and hospitalization of its residents?...Gessert CE, Haller IV, Kane RL et al. Rural-urban differences in medical care for nursing home residents with severe dementia at the end of life. J

Am Geriatr Soc 2006;54:1199-1205. *Journal of the American Geriatrics Society.* 2007;55(3):471-473. *Ineligible study design.*

300. Vogelsmeier A, Anbari A, Ganong L, et al. Detecting Medication Order Discrepancies in Nursing Homes: How RNs and LPNs Differ. *Journal of Nursing Regulation.* 2015;6(3):48-56. *Ineligible intervention.*

301. Voyer P, McCusker J, Cole MG, et al. Nursing documentation in long-term care settings: New empirical evidence demands changes be made. *Clinical nursing research.* 2014;23(4):442-461. *Ineligible setting.*

302. Wachterman M, Marcantonio E, Davis R, McCarthy E. The effect of profit status on hospice: Results from the 2007 national home and hospice care survey. *Journal of General Internal Medicine.* 2010;25(SUPPL. 3):S402-S403. *Ineligible publication type.*

303. Walsh JE, Lane SJ, Troyer JL. Impact of medication aide use on skilled nursing facility quality. *The Gerontologist.* 2014;54(6):976-988. *Ineligible intervention.*

304. Wan TTH. Nursing Care Quality in Nursing Homes: Cross-Sectional Versus Longitudinal Analysis. *Journal of Medical Systems.* 2003;27(3):283-295. *No data 2000 or later.*

305. Wan TTH, Zhang NJ, Unruh L. Predictors of resident outcome improvement in nursing homes. *Western Journal of Nursing Research.* 2006;28(8):974-993. *No eligble outcomes.*

306. Wang H, Ryskina KL, Yun H, Jung H-Y, Chen AT. Characteristics of Nursing Homes by COVID-19 Cases Among Staff: March to August 2020. *Journal of the American Medical Directors Association.* 2021;22(5):960. *Ineligible intervention.*

307. Weech-Maldonado R, Meret-Hanke L, Neff MC, Mor V. Nurse staffing patterns and quality of care in nursing homes. *Health Care Management Review.* 2004;29(2):107-116. *No data 2000 or later.*

308. Weech-Maldonado R, Pradhan R, Dayama N, Lord J, Gupta S. Nursing Home Quality and Financial Performance: Is There a Business Case for Quality? *Inquiry : a journal of medical care organization, provision and financing.* 2019;56:46958018825191. *No eligble outcomes.*

309. Weinberg AD, Lesesne AJ, Richards CL, Pals JK. Quality care indicators and staffing levels in a nursing facility subacute unit. *Journal of the American Medical Directors Association.* 2002;3(1):1-4. *Ineligible intervention.*

310. Wendelboe AM, Avery C, Andrade B, Baumbach J, Landen MG. Importance of employee vaccination against influenza in preventing cases in long-term care facilities. *Infection Control & Hospital Epidemiology.* 2011;32(10):990-997. *Ineligible intervention.*

311. Werner RM, Konetzka RT, Polsky D. The effect of pay-for-performance in nursing homes: Evidence from state medicaid programs. *Health Services Research.* 2013;48(4):1393-1414. *Ineligible intervention.*

312. While A. Lessons from the Evercare evaluation. *British journal of community nursing.* 2007;12(1):46. *Ineligible study design.*

313. White EM, Kosar CM, Feifer RA, et al. Variation in SARS-CoV-2 Prevalence in U.S. Skilled Nursing Facilities. *Journal of the American Geriatrics Society.* 2020;68(10):2167-2173. *Ineligible intervention.*

314. Winblad U, Blomqvist P, Karlsson A. Do public nursing home care providers deliver higher quality than private providers? Evidence from Sweden. *BMC Health Services Research.* 2017;17:1-12. *Ineligible setting.*

315. Wipke-Tevis DD, Williams DA, Rantz MJ, et al. Nursing home quality and pressure ulcer prevention and management practices. *Journal of the American Geriatrics Society.* 2004;52(4):583-588. *No data 2000 or later.*

316. Wowchuk SM, McClement S, Bond J. The challenge of providing palliative care in the nursing home part II: internal factors. *International Journal of Palliative Nursing.* 2007;13(7):345-350. *Ineligible publication type.*

317. Yang BK, Carter MW, Nelson HW, Trinkoff AM. Nurse Staffing and Skill Mix Patterns in Relation to Resident Care Outcomes in US Nursing Homes. *Journal of the American Medical Directors Association.* 2021;22(5):1081. *Ineligible intervention.*

318. Yoon JY, Lee JY, Bowers BJ, Zimmerman DR. The impact of organizational factors on the urinary incontinence care quality in long-term care hospitals: a longitudinal correlational study. *International journal of nursing studies.* 2012;49(12):1544-1551. *Ineligible setting.*

319. You K, Li Y, Intrator O, et al. Do nursing home chain size and proprietary status affect experiences with care? *Medical Care.* 2016;54(3):229-234. *Ineligible intervention.*

320. Young Y, Hannan EL, Barhydt NR, Broderick S, Colello AD. Factors associated with potentially preventable hospitalization in nursing home residents in New York state: A survey of directors of nursing. *Journal of the American Geriatrics Society.* 2010;58(5):901-907. *Ineligible intervention.*

321. Young Y, Inamdar S, Dichter BS, Kilburn H, Jr H. Clinical and nonclinical factors associated with potentially preventable hospitalizations among nursing home residents in New York State. *Journal of the American Medical Directors Association.* 2011;12(5):364-371. *Ineligible intervention.*

322. Yu K, Huey-Ming T, Miller NA. Facility Characteristics and Risk of Developing Pressure Ulcers in US Nursing Homes. *Journal of Nursing Care Quality.* 2016;31(1):E9-E16. *Ineligible intervention.*

323. Yuan Y, Lapane KL, Baek J, Jesdale BM, Ulbricht CM. Nursing Home Star Ratings and New Onset of Depression in Long-Stay Nursing Home Residents. *Journal of the American Medical Directors Association.* 2019;20(10):1335-1335. *Ineligible intervention.*

324. Yue L, Harrington C, Temkin-Greener H, et al. Deficiencies In Care At Nursing Homes And Racial/Ethnic Disparities Across Homes Fell, 2006-11. *Health Affairs.* 2015;34(7):1139-1146. *No eligble outcomes.*

325. Yue L, Xueya C, Zhiqiu Y, Glance LG, Harrington C, Mukamel DB. Satisfaction With Massachusetts Nursing Home Care Was Generally High During 2005-09, With Some Variability Across. *Health Affairs.* 2013;32(8):1416-1425. *Ineligible intervention.*

326. Zhang N, Li Y, Temkin-Greener H. Prevalence of Obesity in New York Nursing Homes: Associations With Facility Characteristics. *Gerontologist.* 2013;53(4):567-581. *No eligble outcomes.*

327. Zhang NJ, Unruh L, Wan TTH. Gaps in nurse staffng and nursing home resident needs. *Nursing economic$.* 2013;31(6):289-297. *Ineligible intervention.*

328. Zhang NJ, Wan TTH. Effects of institutional mechanisms on nursing home quality. *Journal of health and human services administration.* 2007;29(4):380-408. *Ineligible intervention.*

329. Zhao M, Haley DR. Nursing home quality, staffing, and malpractice paid-losses. *Journal of Health Care Finance.* 2011;38(1):1-10. *No eligble outcomes.*

330. Zheng NT, Temkin-Greener H. End-of-life care in nursing homes: The importance of CNA staff Communication. *Journal of the American Medical Directors Association.* 2010;11(7):494-499. *Ineligible intervention.*

331. Zimmaro Bliss D, Zehrer C, Savik K, Thayer D, Smith G. Incontinence-associated skin damage in nursing home residents: a secondary analysis of a prospective, multicenter study. *Ostomy/wound management.* 2006;52(12):46-55. *Ineligible intervention.*

332. Zimmerman S, Gruber-Baldini AL, Hebel JR, Sloane PD, Magaziner J. Nursing home facility risk factors for infection and hospitalization: importance of registered nurse turnover, administration, and social factors. *Journal of the American Geriatrics Society.* 2002;50(12):1987-1995. *No data 2000 or later.*

333. Zimmerman S, Magaziner J, Birge SJ, Barton BA, Kronsberg SS, Kiel DP. Adherence to hip protectors and implications for U.S. long-term care settings. *Journal of the American Medical Directors Association.* 2010;11(2):106-115. *Ineligible intervention.*

334. Zuidema SU, Koopmans RTCM, De Jonghe JFM, Verhey FRJ. Psychotropic drug prescription in nursing home patients with dementia: Influence of environmental correlates and staff distress on physicians' prescription behavior. *International Psychogeriatrics.* 2011;23(10):1632-1639. *Ineligible setting.*

APPENDIX C. CRITERIA USED IN QUALITY ASSESSMENT

Question	Yes	No	Unclear
1. Is it clear in the study that the "staffing level/mix" preceded the outcome of interest?			
2. Were the criteria for inclusion in the sample clearly defined?			
3. Were the study subjects (*ie*, nursing homes) and the setting (*ie*, geography, national vs state, number of homes) described in detail?			
4. Was the exposure (staffing level/mix) measured in a valid and reliable way?			
5. Were confounding factors identified?			
6. Were strategies to deal with confounding factors stated?			
7. Were the outcomes measured in a valid and reliable way?			
8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?			
9. Was the appropriate statistical analysis used?			

**If all responses are "yes" overall ROB = low, if 2 or more responses are "no" overall ROB = high, all other combinations overall ROB = moderate

APPENDIX D. QUALITY RATINGS FOR ALL ELIGIBLE STUDIES

Author	Is it clear in the study that the "staffing level/ mix" preceded the outcome of interest?	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects (*ie*, nursing homes) and the setting (*ie*, geography, national vs state, number of homes) described in detail?	Was the exposure (staffing level/mix) measured in a valid and reliable way?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Was the appropriate statistical analysis used?	Overall
Abrahamson[54]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Alexander[25]	Unclear	Yes	Yes	Yes	No	No	Yes	Not applicable	Yes	Low
Arling[51]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
Bosco[37]	Unclear	Yes	Yes	Yes	Unclear	No	Yes	Not applicable	Yes	Low
Bostick[34]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Low
Bowblis[60]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Moderate
Castle[55]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Castle[31]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Moderate
Castle[33]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Castle[36]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Castle[26]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate

Author	Is it clear in the study that the "staffing level/ mix" preceded the outcome of interest?	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects (*ie*, nursing homes) and the setting (*ie*, geography, national vs state, number of homes) described in detail?	Was the exposure (staffing level/mix) measured in a valid and reliable way?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Was the appropriate statistical analysis used?	Overall
Castle[56]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Moderate
Castle[35]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Castle[57]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
Castle[38]	Unclear	Yes	Yes	Yes	Yes	Yes	No	Unclear	No	Low
Crawford[77]	Yes	Unclear	Unclear	Yes	Yes	No	Yes	Yes	No	Low
Domi[48]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Flynn[32]	Unclear	Yes	Yes	Yes	Unclear	Unclear	Yes	Not applicable	Unclear	Moderate
Gorges[49]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
Harrington[11]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Hefele[61]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Moderate
Konetzka[18]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
Lee[28]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Leland[62]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
Lerner[58]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate

Author	Is it clear in the study that the "staffing level/ mix" preceded the outcome of interest?	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects (*ie*, nursing homes) and the setting (*ie*, geography, national vs state, number of homes) described in detail?	Was the exposure (staffing level/mix) measured in a valid and reliable way?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Was the appropriate statistical analysis used?	Overall
Li[39]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Lin[27]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Moderate
Ogunneye[45]	No	Yes	Unclear	Unclear	Yes	No	Yes	Unclear	No	Low
O'Malley[46]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Orth[42]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	No	Moderate
Shin[53]	Unclear	No	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Shin[78]	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Not applicable	Unclear	Low
Shippee[52]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Moderate
Temkin-Greener[59]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Temkin-Greener[30]	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Not applicable	Yes	Moderate
Thomas[43]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Tong[64]	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Trinkoff[29]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate

Author	Is it clear in the study that the "staffing level/ mix" preceded the outcome of interest?	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects (*ie*, nursing homes) and the setting (*ie*, geography, national vs state, number of homes) described in detail?	Was the exposure (staffing level/mix) measured in a valid and reliable way?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Was the appropriate statistical analysis used?	Overall
Trivedi[41]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Moderate
Uchida-Nakakoji[40]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
Warren[63]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	High
White[24]	Unclear	Unclear	Yes	Unclear	Yes	No	Yes	Unclear	No	Low
Xing[44]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate
Xu[47]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Yes	Moderate

APPENDIX E. PEER REVIEW DISPOSITION

Comment #	Reviewer #	Comment	Author Response
Are the objectives, scope, and methods for this review clearly described?			
1	1	Yes	Thank you.
2	3	Yes	Thank you.
3	4	Yes	Thank you.
4	5	Yes	Thank you.
5	6	Yes	Thank you.
6	9	Yes	Thank you.
Is there any indication of bias in our synthesis of the evidence?			
7	1	No	Thank you.
8	3	No	Thank you.
9	4	No	Thank you.
10	5	No	Thank you.
11	6	No	Thank you.
12	9	No	Thank you.
Are there any published or unpublished studies that we may have overlooked?			
13	1	No	NA
14	3	Yes - See my general comments for additional papers that should be included, and why Nurse staffing and patient outcomes: Strengths and limitations of the evidence to inform policy and practice. A review and discussion paper based on evidence reviewed for the National Institute for Health and Care Excellence Safe Staffing guideline development. P. Griffiths, J. Ball, J. Drennan, C. Dall'Ora, J. Jones, A. Maruotti, et al. Int J Nurs Stud 2016 Vol. 63 Pages 213-225 Accession Number: 27130150 DOI: 10.1016/j.ijnurstu.2016.03.012	Thank you for the suggested articles; however, none of these met our inclusion criteria. Griffiths et. al. is a review article, and not an eligible study design. Needleman et. al. and Winter et al. both addressed nurse staffing in hospitals, which was not an eligible setting for this review.

Comment #	Reviewer #	Comment	Author Response
		Nurse staffing and inpatient hospital mortality. J. Needleman, P. Buerhaus, V. S. Pankratz, C. L. Leibson, S. R. Stevens and M. Harris. N Engl J Med 2011 Vol. 364 Issue 11 Pages 1037-45. Accession Number: 21410372 DOI: 10.1056/NEJMsa1001025 Winter SG, Bartel AP, de Cordova PB, Needleman J, Schmitt SK, Stone PW, Phibbs CS. The Effect of Data Aggregation on Estimations of Nurse Staffing and Patient Outcomes. In press, Health Services Research, 2021;56(6):1262-1270. DOI: 10.1111/1475-6773.13866 PMID: 34378181	
15	4	Yes - Please see below re: COVID19 papers (comment 3c) and acknowledgment of other reviews that have been done on this literature (comment 4)	We note again that published reviews are not eligible for inclusion in this systematic review. We examined the studies included by the suggested review, and did not find any additional eligible articles for our review. Several of the articles included by the other review are already included in our review. One of the articles included by the suggested review, McGarry 2021, was published after our original search date. We now refer to this article in the Discussion, and note that these results would not have changed our overall findings or conclusions.
16	5	No	NA
17	6	No	NA
18	9	No	NA
Additional suggestions or comments can be provided below.			
19	1	This is a systematic review of nurse staffing in nursing homes and associated outcomes using 4 databases with a structured literature search. Because nurse staffing is never randomized, the systematic review focuses on cohort studies of nurse staffing and patient outcomes including pressure ulcers (PU), nursing home infections (NHAI), hospitalizations, pain and catheters. Studies were evidence graded and have	NA

Comment #	Reviewer #	Comment	Author Response
		variable quality. The authors separate the staffing questions into RN, LPN and NA for each outcome. The executive summary is fairly long (14 pages). I am not sure of the ESP standards but typically exec summaries are 1-2 pages. The detail will be appreciated by some reviewers, but not by others. Page 8 Line 33-34 – please check the federal VA budget for currently operational CLC beds. The number is closer to 8500. Page 10 Line 34 Pressure Ulcers – Is there a GRADE for this evidence? How is age of the literature accounted? Most of these analyses were related to MDS 2.0 in a time when staffing was measured by self-report (not CMS payroll journal records). The preponderance of studies by 1 group is potentially a strength (the researchers know the topic and measurement structure) and a bias ("we are hell bent on showing that RN staffing is critical and LPN staffing is…") Page 11, NHAI – is there a GRADE for the evidence? Page 12, line 23 – Do you need an extra zero in the p-value?	The Executive Summary in this report is consistent with length of summaries in other ESP reports. Generally, ESP Executive Summaries are more than 2 pages long. It is unclear if reviewer is perhaps thinking of ESP management ebriefs (which are shorter, targeted communications that are prepared after the final report), or perhaps another ESP product (*eg*, Evidence Briefs). However, per reviewer's concern, we have further edited the executive summary for greater brevity. We originally referenced a government report that described VA CLC's in 2018. Per reviewer's suggestion, we have now updated the number of CLC beds based on VA's proposed FY 2022 budget (8,480). In the main text, Table 5 provides the summary of results and GRADE ratings for pressure ulcers. Similarly, Table 6 describes the results and GRADE ratings for nursing home-associated infections. GRADE ratings take into account methodological limitations (including concerns regarding accuracy or bias of datasources) and overall consistency of results across studies, along with other domains (see Methods). The concern with age of the literature, if not directly related to accuracy of the data, would be considered in the Indirectness domain, which looks at whether study results are applicable and meaningful for the KQ addressed by our review. For consistency, we have reported p-values throughout this review with the leading zero. All 4 studies described in this section had controlled for nursing home size. Three of these also adjusted for a measure of COVID-19 prevalence in the community (*eg*,

Comment #	Reviewer #	Comment	Author Response
		Page 12, line 18 – Was community prevalence and facility size included in these studies? Both increase the likelihood of introduction into NHs.	COVID-19 cases per 1,000 residents). We have added this information to the Results.
		Page 12, line 56 – I very much appreciate the analysis of UTI. While perhaps outside the scope, I am wondering if the studies postulated a potential mechanism. The reason for the comment is that this section may be intertwined with the Urinary Catheter analysis.	We appreciate reviewer's suggestion regarding potential link between the use of urinary catheters and rates of UTI in nursing homes. However, this relationship was not examined in the 3 moderate-quality studies which addressed both UTI and urinary catheters (Trinkoff 2013, Lee 2014, and Castle 2010). Instead, urinary catheters and UTI (both assessed using MDS) were modeled as different outcomes in separate analyses. Additionally, there were several studies that examined only urinary catheters or UTI, without having the other outcome.
		In addition, it may be important to include dates on these studies (at least pre & post MDS 3.0), the differences in the MDS 2.0 and MDS 3.0 are important. Also there have been various initiatives over the years.	We note both the publication dates and the dates of data (for nurse staffing and outcomes) in Appendix tables. We agree that changes in outcomes assessment (*eg*, due to newer reporting processes to MDS) are important considerations and have highlighted these in the relevant Results sections and the Discussion. Thank you.
		Page 14 Line 6 – Of the 6 studies, 5 were conducted by the same PI? Thanks for bringing it up – see comment about bias above.	As noted above, there were several studies that addressed UTI but not urinary catheters. Only 1 of the 5 studies examining UTI were conducted by Castle et al.
		Page 15 line 7 – Similar comment on bias by a single PI Should this be included with NHAI – UTI? Perhaps not, but the clinical undertone of catheter use is UTI predisposition…	The timing of staffing and outcomes assessment was a substantial methodological limitation for many of the included studies. We have provided more information about this for the specific section indicated by reviewer, and also expanded on this in the Results overview and Discussion.
		Page 15 line 46 – Should there be a comment that sometimes the MDS was after the staffing measurement?	

Comment #	Reviewer #	Comment	Author Response
		Page 16 line 42 – were all deficiency citations included? Some deficiencies are directly related to staffing.	We describe in greater detail the type of deficiency citations within the main text Results and in Appendix Table F-6. Eligible studies addressing deficiency citations counted a variety of different citations, but these had to be relevant to resident safety and/or quality of care (*eg*, infection control or medication management). We have clarified this in the Executive Summary—Results section.
		For the summary of Key findings Page 18 line 9 – please make sure that all of the GRADES are included in the text of the executive summary.	We have ensured that all GRADE certainty of evidence ratings are included in the text of the Executive Summary in each applicable section.
		Page 20 line 6 – there is finally a reference for the VA CLC Population: https://www.jamda.com/article/S1525-8610(21)00910-5/fulltext	We have added this citation to the Discussion.
		Page 20 line 19-24 – Great example and important point!	Thank you.
		Page 21 line 28 – Great point about changes in NHs since 2000.	The prescribing and use of a medication is usually considered a process in the Donabedian model. A process of care is defined as "what is actually done in giving and receiving care" [Donabedian, JAMA 1988].
		Page 25 Fig 1 – I am not sure how AP meds are a 'process', but will allow for your conceptual diagram.	Thank you. The GRADE methodology for determining certainty of evidence is complex and tailored to the specific outcomes of interest. We have provided citations and greater explanation in the relevant Methods section (main text).
		Page 34 table 5 – these are really powerful tables! I know that you have referenced the methodology. Please consider giving a paragraph or footnote to defining each of the column headers	
20	3	Overall, the review conducted is sound and the conclusions are supported by the evidence.	Thank you.

Comment #	Reviewer #	Comment	Author Response
		One issue that should probably be noted is that the 1 VA CLC nurse staffing study included in this review used a statistical method that, given the very high VA staffing levels, was essentially set up to not find effects for staffing levels. That study was designed to look at the effects of unit tenure on outcomes; it did find that increased RN and LPN tenure was associated with better outcomes. Since it used a fixed-effects model, the estimates for the effect of staffing (HPPD) were driven by deviations from each unit's average staffing level. Given the very high VA CLC staffing levels (see below), modest reductions in staffing probably can't be expected to have any effect on patient outcomes. A note to this effect should probably be added to the detailed discussion of the findings of this paper.	We agree that comparisons among VA CLCs would only detect impacts of nurse staffing that are relevant at high staffing levels, particularly as compared with non-VA community nursing homes. However, we do not believe that this limitation could be addressed by different statistical techniques (*eg*, using random effects models). In the Discussion, we have emphasized that no eligible study compared outcomes between VA and non-VA nursing homes, and that this is a substantial gap in the evidence.
		In the discussion, I think that more emphasis/comment needs to be made to make it very clear that the staffing in CLCs is very different from community nursing homes. There are several relevant issues. 1. VA RN wages are set by law to match of the average of the CMS wage index, and this is dominated by the nursing salaries for RNs working in acute care. Acute care RNs receive a premium, compared to RNs who work in other settings, thus the wages that VA pays for RNs working in CLCs are above market. 2. Related, there is some evidence that at least some RNs take positions in the CLC as a stepping stone to get into the VA, and then transfer to another RN position when 1 becomes available. 3. For LPNs and Aides, the VA wage differential with the community nursing homes varies by market, but it is almost always competitive, and in some markets may be above market. 4. For all nursing staff, the VA benefit package is almost always better than the average benefit package for community nursing homes, sometimes significantly better.	We have expanded the Discussion section describing the many differences between VA CLCs and community nursing homes. We agree with reviewer that VA work environment and salary/benefits are likely more attractive for many nurses, but we did not find published references or publicly available reports that clearly describe these differences. Thus, we discuss these potential differences in work environment and other workforce factors in more general terms.

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		5. For LPNs and Aides, the VA offers training benefits that are, on average, significantly better than what is offered in the community; these are set to match those offered by acute care hospitals. Thus, there is a path to advance up the ladder with sudsidized training that is not offered by many community nursing homes. 6. **** All of the above contribute to VA being considered to be a top-tier employer for staff working in nursing homes. This results is MUCH lower staff turnover. The average tenure of an Aide working on a specific CLC unit in the VA is over 4 years, while in most community nursing homes it is less than a year!	
		Related note, on page 20 it is noted that nursing homes may be a less desirable type of employment, compared to hospitals, due to differences in salary and benefits. While this is true in general, it does not apply to the VA, given how VA wages and benefits are set.	As noted above, we have highlighted differences between VA CLCs and community nursing homes. This sentence addressed the situation for community nursing homes, as most eligible studies used data for community facilities.
		Main comment is that the discussion of the findings and limitations of the existing evidence only considers the work that has been done looking at how nurse staffing affects patient outcomes for long term care. The number of high-quality studies is limited, and there are some lessons that could potentially be learned from the work that has been done for acute medical/surgical care. Specifically, there is a very good summary of the limitations of the work on nurse staffing in acute care by Griffiths et al, 2016. Listed at end of this file. Many of the issues identified in that paper are also relevant to long term care.	The impact of nurse staffing on outcomes in acute care settings is outside the scope of this review. We agree that there are likely similar concerns regarding methodological limitations and gaps in evidence.
		Endogeneity and how nurse staffing is measured are key limitations of much of the literature on how nurse staffing affects patient outcomes. It was noted that many of the studies relied on surveys to determine nurse staffing levels, and this method is subject to bias. Further, with only a few	We agree that method of assessing nurse staffing is a major methodological concern for this body of evidence (and an important reason that there is low certainty of evidence for most outcomes). We have added the

Comment #	Reviewer #	Comment	Author Response
		exceptions, most of the studies of nurse staffing rely in very aggregated data to measure nurse staffing (e.g., annual data). This masks the fact that there can be considerable variation in staffing levels over time. Again, from the acute care literature, Winter et al, 2021 show that there is considerable aggregation bias. Further, Needleman et al, 2011 show that shift to shift variance in staffing affects outcomes. Minor Comment: Page 20, middle, estimated RN salary and benefits. The estimated RN salary is FAR too low. HERC annually creates a dataset of the average VA wage costs for each type of employee. For the most recent year, the average RN costs (salary plus benefits) for an FTE was $131,643 from MCA data and $136,406 using FMS data. The data in the report should be updated. All of the above should then be factored into the discussion about the needs for additional research. Nurse staffing and patient outcomes: Strengths and limitations of the evidence to inform policy and practice. A review and discussion paper based on evidence reviewed for the National Institute for Health and Care Excellence Safe Staffing guideline development. P. Griffiths, J. Ball, J. Drennan, C. Dall'Ora, J. Jones, A. Maruotti, et al. Int J Nurs Stud 2016 Vol. 63 Pages 213-225 Accession Number: 27130150 DOI: 10.1016/j.ijnurstu.2016.03.012 Nurse staffing and inpatient hospital mortality. J. Needleman, P. Buerhaus, V. S. Pankratz, C. L. Leibson, S. R. Stevens and M. Harris. N Engl J Med 2011 Vol. 364 Issue 11 Pages 1037-45. Accession Number: 21410372 DOI: 10.1056/NEJMsa1001025	specific issue that data on nurse staffing did not allow for examination of variation (over time) in staffing levels. We used an estimate for RN salary from publicly available information on salary.com; this most likely reflects community salaries. This is appropriate since most eligible studies examined outcomes in community nursing homes (and not VA CLCs). Additionally, we do not believe that these costs for VA nurses are publicly available (*eg*, these data are accessed via VA intranet sites). Thus, we have added a sentence that states generally that VA salaries tend to be higher. Finally, we used this example to highlight the high costs of changing nurse staffing to improve resident outcomes. Using the higher estimates for VA RN salaries would make this even more true (and not less so). As noted above, evidence on impact of nurse staffing on outcomes in acute care facilities is outside the scope of this review.

Comment #	Reviewer #	Comment	Author Response
		Winter SG, Bartel AP, de Cordova PB, Needleman J, Schmitt SK, Stone PW, Phibbs CS. The Effect of Data Aggregation on Estimations of Nurse Staffing and Patient Outcomes. In press, Health Services Research, 2021;56(6):1262-1270. DOI: 10.1111/1475-6773.13866 PMID: 34378181	
21	4	Thank you for the opportunity to review this synthesis of the literature assessing relationships between nursing home staffing and resident outcomes. Overall the review is well-organized, written clearly, and appears to have been conducted using robust methods. However, there are a number of issues that do need to be addressed. Please see below for specific comments.	Thank you.
		1. There appears to be some miscoding of the quality assessments. In Appendix C, 1 would think that a 'yes' to all questions would equate with 'high' quality, but the note at the bottom suggests the opposite. I also see some discrepancies across tables – e.g. the Konetzka 2008 paper [ref 18] is given a rating of 'low' in Appendix D (even though it is regarded by most experts as 1 of the strongest papers in this literature); but then is later described as high quality in Appendix F-1. The Harrington 2020 paper [ref 10] is given a 'low' rating in Appendix D, but a 'high' rating in Appendix F-2. These are just 2 examples, but there appear to be other discrepancies.	These discrepancies were due to some inconsistencies in our terminology, namely that a study with high risk of bias is low overall quality and vice versa. We have corrected the appendix tables to consistently refer to "high" (or "low") quality as appropriate.
		2. There are several papers in Appendix D that do not appear in the Appendix F evidence tables, so were they actually included in the review of any outcomes? Among just the first few papers listed in Appendix D, I do not see Alexander, Bosco, or Bostick included anywhere in Appendix F.	As stated in the Methods, we did not undertake detailed data abstraction from low-quality studies; thus these are not included in detailed results tables (Appendix F).
		3. The review of COVID-19 outcomes (p.11-12) needs to be expanded in three ways: a. First, there needs to be some separation of outcomes – I would examine probability of any outbreak, case rates, and	We present summary findings by different types of nurse staffing (*eg*, RN or LPN) because our Technical Expert Panel recommended this as the most useful and relevant format. Detailed results for each of these studies are

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		mortality rates separately, as these are conceptually different from 1 another. (i.e. Better staffing is unlikely to prevent the virus from initially walking in the door, but may help to mitigate outbreaks and adverse outcomes once an incident case is identified.) b. Quality assessment for COVID19 studies needs to include whether the study controlled for community virus prevalence & bed size, as these have been identified as the strongest and most consistent predictors of nursing home cases & deaths. See this review: https://pubmed.ncbi.nlm.nih.gov/34549415/ c. There are several other studies that have examined various aspects of NH staffing and COVID19 outcomes, most of which I believe were done within the timeframe of your review. See link in (3b), section on staffing, for some additional articles you probably should incorporate.	described in Appendix Table F-2. We agree that there is substantial heterogeneity in outcomes assessed by studies examining COVID-19. For example, there were not only differences in terms of counting cases, outbreaks (variably defined), and/or deaths, but also in the method for data collection (*eg*, CMS data vs. newspaper reports). Additionally, 2 studies were focused on data within a single state, 1 study used national data, and 1 study examined only nursing homes participating in a COVID-19 vaccination program. Therefore, there are substantial conceptual differences and concerns on multiple levels (beyond the type of outcomes included) in aggregating results across these studies. These concerns led to the "Low" and "Very Low" GRADE ratings for summary findings regarding COVID-19. Additionally, as part of quality assessment and determining the GRADE ratings, we also considered whether studies controlled for community prevalence and nursing home size. We have provided more information on these analytic factors in the Results. Please see above response to comment #15 (Reviewer 4) regarding articles included by Konetzka et al. review.
		4. There have been at least 6 reviews of the nursing home staffing-quality literature to date (listed below), and an additional review of nursing home hospitalizations that included a section on staffing (Grabowski et al, 2008). These should be mentioned somewhere in the discussion, with a comment as to how the current review adds to this existing evidence base, and how findings align or contrast with those of prior reviews. I see the Dellefield review in your reference list but couldn't find an in-text citation. I don't believe any of these others were cited. a. Bostick JE, Rantz MJ, Flesner MK, Riggs CJ. Systematic review of studies of staffing and quality in nursing homes. J	This ESP report was conducted primarily to meet needs identified by our VA operational partners in the Office of Nursing Services, and Geriatrics and Extended Care. In our initial discussions with our VA partners, we noted there were previously published reviews, although most of these were conducted >5 years ago (the exception being the Clemens et al. review, which was not yet published at that time). For various reasons, the existing reviews did not meet the needs of our partners. As per recommended format for ESP reports, our Discussion focuses on interpretation of the evidence, including implications for VA policy and practice, and identification of evidence gaps. As systematic reviews were not

Comment #	Reviewer #	Comment	Author Response
		Am Med Dir Assoc. 2006;7(6):366-376. b. Castle NG. Nursing home caregiver staffing levels and quality of care - A literature review. Journal of Applied Gerontology. 2008;27(4):375-405. c. Dellefield ME, Castle NG, McGilton KS, Spilsbury K. The Relationship Between Registered Nurses and Nursing Home Quality: An Integrative Review (2008-2014). Nursing Economics. 2015;33(2):95-+. d. Spilsbury K, Hewitt C, Stirk L, Bowman C. The relationship between nurse staffing and quality of care in nursing homes: a systematic review. Int J Nurs Stud. 2011;48(6):732-750. e. Backhaus R, Verbeek H, van Rossum E, Capezuti E, Hamers JP. Nurse staffing impact on quality of care in nursing homes: a systematic review of longitudinal studies. J Am Med Dir Assoc. 2014;15(6):383-393. f. Clemens S, Wodchis W, McGilton K, McGrail K, McMahon M. The relationship between quality and staffing in long-term care: A systematic review of the literature 2008-2020. Int J Nurs Stud. 2021;122:104036. g. Grabowski DC, Stewart KA, Broderick SM, Coots LA. Predictors of nursing home hospitalization: a review of the literature. Med Care Res Rev. 2008;65(1):3-39.	eligible study designs for this report, we did not carefully assess and compare findings from reviews (such as those noted here). Therefore, we do not present detailed results or summaries from these reviews. We have added a more general comparison of our review with some of the previous systematic reviews. The Dellefield et al. review was cited already in the Introduction (page 25). Finally, some of these are not systematic reviews (*eg*, Castle 2008; Grabowski 2008) or largely included studies published >20 years ago (Bostick 2006).
		5. Missing from the discussion is an acknowledgment that 1 of the biggest limitations of the staffing literature to date has been the predominance of studies using OSCAR/CASPER data, which was long criticized for reporting bias since it only captured facility-reported staffing levels around the time of survey. See discussion in the Castle 2008 review (https://journals.sagepub.com/doi/10.1177/0733464808321596) about this, and Exhibit 3 in Geng et al 2019 (ref 12) for an illustration of the reporting bias. This is why CMS transitioned to the current Payroll-based Journal system in 2016.	We agree with reviewer that there are substantial concerns with data accuracy nurse staffing. We have clarified and highlighted these concerns in the Discussion.
		6. Discussion, p. 50, lines 28-31. The limitation about not measuring other organizational factors needs to be	As suggested by the reviewer, we have expanded this Discussion paragraph to include a reference to new CMS

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		expanded, particularly as it relates to other workforce factors that impact resident outcomes. Staffing levels alone are very limited measures that solely tell us on average how many people are in the building, but tell us nothing about staff retention, turnover, agency use, consistency of assignments, staff engagement, or leadership. Evidence from hospitals suggests that higher nurse staffing is only associated with better patient outcomes in hospitals where other aspects of supportive work environments are also present (e.g. https://pubmed.ncbi.nlm.nih.gov/21945978/). There is only preliminary evidence on the contribution of work environment, measured from staff surveys, to resident outcomes in nursing homes (eg. refs 22, 28, 30, 57). There have been several papers on the negative consequences of turnover in nursing homes (by Castle and others) and CMS has just announced that they will begin reporting turnover measures in NH Compare which will allow for further exploration. I would acknowledge the need to develop these areas of evidence in your section on research gaps.	data collection on turnover, and the likely importance of other workforce and work environment factors. Although some of the included studies did address factors such as turnover and use of agency staff, these were not the focus of this review. Therefore, we cannot state how important these specific factors may be, particularly as compared with nurse staffing levels, or whether there are substantial evidence gaps in understanding the role of these factors.
		Minor 7. Suggest adding number in-text citations throughout your results, at least when you are calling out specific studies. As is, it is difficult to tell which papers you are referencing as you summarize findings.	In-text citations are included throughout the Results section of the main text. Citations are not included in the Executive Summary as this is meant to be a more concise summary of the available evidence.
		8. Pg. 19, line 47 – replace ‘physician extenders’ with the more appropriate term ‘advanced practice clinicians’ or ‘advanced practice providers’	We have replaced this term with “non-physician providers”, as it is unclear whether advanced practice clinicians would include physician assistants (and other categories of non-physician providers).
22	5	Page 9, line 3 - should be “function” (not “functioning”) --- also noted in other areas of the manuscript.	Both “function” and “functioning” have been used in the literature to describe ability to do (or difficulty with) daily tasks and participation in meaningful activities. For example, the Veterans SF-36 has a “physical functioning domain” [Kazis et al. *Arch Intern Med*, 1998] and ADLs

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			have been used to assess "physical functioning" [Katz, *JAMA*, 1963].
		Page 11, line 24 - what is the definition of "total staffing"? Number of RN, LPN, and NAs combined?	We have added the definition of total staffing to Methods.
		Page 14, line 44-45 - missing "the" in "…nursing home being in THE highest 75th percentile for…"	This has been corrected.
		Page 15, line 28 - I believe this should be "Function" (not "Functioning")… same comment for line 30	See response above.
		Page 18, line 12, Discussion - this is the first time that the KQ 1 and 2 are mentioned in the Executive Summary section. Consider introducing KQ1 and 2 earlier in the Executive Summary.	We have added the KQ to the Methods in the Executive Summary.
		Page 19, line 46 (also on page 48, line 44) - in lieu of "physician extenders", consider using actual roles (ie, nurse practitioners, physician assistants) - see https://www.aanp.org/advocacy/advocacy-resource/position-statements/use-of-terms-such-as-mid-level-provider-and-physician-extender	This has been addressed (see response to Reviewer #4 above).
		Page 20 line 40-41 - unclear sentence, please clarify - "….VA CLCs to invest in additional avenues to improve specific resident outcomes have options."	This sentence has been edited for clarity.
		Page 25, Figure 1 - shouldn't there be a line from the "structure" directly to the "outcomes" as well (not just from "resident characteristics" to "outcomes")?	The relationships between structure, processes, and outcomes are per previous descriptions of the Donabedian model (*eg*, Donabedian, JAMA 1988). In this figure, we only highlighted the processes of interest (for this review); there are clearly many other processes of care that would mediate the impact of organizational structure on resident outcomes. We have added ellipses to denote this.

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		Page 26, Table 1 - RN Responsibilities column - RNs are also responsible for the application of the nursing process for each patient they care for, which includes identifying nursing diagnoses and implementation of nursing interventions that is individualized to the patient. Another potential discussion point/limitation - nursing practice is governed by state nursing practice acts, which may affect processes of care and/or outcomes.	We used information from the Bureau of Labor Statistics for these general descriptions of different nurse staffing for nursing homes. We agree that there is variation in nursing practice across states, but also likely by settings (including different nursing homes).
23	9	Page 19 line 47 and page 48 line 44, the term physician extenders should not be used. If referring to advance practice providers (PAs, NPs, CNSs), either use the individual clinical professions, providers or the term advance practice providers. Page 49 and page 20, the sentence that starts on line 37 is not clear.	This has been addressed (see response above to Reviewer #4). We have edited this sentence for clarity.

APPENDIX F. EVIDENCE TABLES

Appendix Table F-1. Nursing Home Staffing Associations with Urinary Catheter Usage, Nursing Home-Associated Infections (non-COVID-19), and Pressure Ulcers

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
Castle, 2015[26]; Moderate; Cross-sectional; 3,939 free-standing NH (≥30 beds) national sample	OSCAR (2008); FTE per 100 residents (not including agency staff), mean (SD): RN 11.7 (9.3), LPN 14.6 (8.4), NA 30.4 (9.5) Skill mix—RN/(LPN+NA), mean (SD): 0.25 (0.4) % FTE filled by agency staff, mean (SD): RN 9.7% (3.3), LPN 11.2% (3.5), NA 12.1% (4.2)	NH Compare, AHRF, Survey (2008); Negative binominal regression models were used, case mix adjusted	**Association between staffing and percent of residents with pressure ulcers(IRR [95% CI])** NA staffing level 0.93* [0.81, 0.97] LPN staffing level 0.83 [0.77, 1.01] RN staffing level 0.97* [0.91 , 0.99] Staff mix 0.98** [0.88, 0.99] *p < 0.5 ** p < 0.01	NR	**Association between staffing and percent of residents with urinary catheter left in (IRR [95% CI])** NA staffing level 0.94* [0.86, 0.99] LPN staffing level 0.88 [0.79, 1.01] RN staffing level 0.98* [0.83 , 0.99] Staff mix 0.96* [0.81, 0.99] *p < 0.5
Castle, 2011[31]; Moderate; Longitudinal; 2,839 free-standing NH (≥30 beds) national sample	OSCAR (2003 – 2007); FTE per 100 residents (not including agency staff), mean (SD): RN 11.7 (9.3), LPN 14.6 (8.4), NA 30.4 (9.5) Skill mix—RN/(LPN+NA), mean (SD): 0.25 (0.4)	NH Compare, Survey (2003 – 2007); Negative binominal regression models were used.	**Association between change in staffing and percent of low-risk residents with pressure sores (β (SE)):** higher NA staffing levels -0.81* (0.11) higher LPN staffing levels -0.16* (0.04) higher RN staffing levels -0.46* (0.17)	NR	**Association between change in staffing and percent of residents with a urinary catheter (β (SE)):** higher NA staffing levels -0.36 (0.48) higher LPN staffing levels -0.49 (0.68) higher RN staffing levels -0.44* (0.06)

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
	% FTE filled by agency staff, mean (SD): RN 9.7% (3.3), LPN 11.2% (3.5), NA 12.1% (4.2)		higher staff mix -0.42*** (0.21) *p< .001, ** p<.05		higher staff mix -0.03** (0.01) *p< .001, ** p< .01
Castle, 2007[33]; Moderate; Cross-sectional; 1,071 free-standing NH (≥30 beds) national sample	OSCAR (March – June 2003); FTE per 100 residents (not including agency staff), mean (SD): RN 14.7 (9.3), LPN 16.6 (8.1), NA 33.4 (10.1) % FTE filled by agency staff, mean (SD): RN 7.7% (12.7), LPN 1.9% (3.9), NA 20.2% (18.9)	NH Compare, AHRF, Survey (2003 – 2005); Negative binomial regression models, coefficients (SE), *significant at 5%; **significant at 1%	**Association between staffing characteristics and pressure sores for low and high risk residents:** <u>Low Risk Residents</u> Log RN Staffing 0.939 (0.101) Log LPN Staffing 1.137** (0.055) Log NA Staffing 1.076 (0.173) <u>High Risk Residents</u> Log RN Staffing 0.808** (0.045) Log LPN Staffing 0.919 (0.111) Log NA Staffing 1.099 (0.084)	NR	**Association between staffing characteristics and insertion of urinary catheter that was left in:** Log RN Staffing 0.769** (0.058) Log LPN Staffing 0.991 (0.061) Log NA Staffing 1.066 (0.155)
Castle, 2010[35]; Moderate; Cross-sectional;	NHA survey (2005); FTE per 100 residents (not including agency staff), mean (SD): RN 12.2 (8.2), LPN 12.5 (6.5), NA 25.8 (7.0)	NH Compare (2005); SEM path analysis, only coefficients with p≤0.5 were reported (otherwise NR), case mix adjusted	**SEM path coefficients for % of residents with pressure ulcer:** <u>RN staffing</u> Long-stay (high risk) NR Long-stay (low risk) -0.10 Short-stay -0.05	**SEM path coefficients for % residents with UTI**: RN staffing 0.05 LPN staffing NR NA staffing -0.03 RN agency NR	**SEM path coefficients for % of residents with urinary catheter left in:** NA staffing 0.04 LPN staffing NR RN staffing NR LPN agency -0.07

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
2,840 free-standing NH (≥30 beds) national sample	Agency staff FTE per 100 beds, mean (SD): RN 1.6 (1.2), LPN 2.9 (1.9), NA 6.9 (3.4)		LPN staffing Long-stay (high risk) NR Long-stay (low risk) -0.07 Short-stay NR NA staffing Long-stay (high risk) -0.02 Long-stay (low risk) -0.04 Short-stay -0.07 RN agency Long-stay (high risk) NR Long-stay (low risk) NR Short-stay NR LPN agency Long-stay (high risk) -0.12 Long-stay (low risk) 0.05 Short-stay NR NA staffing Long-stay (high risk) 0.65 Long-stay (low risk) 0.56 Short-stay 0.33	LPN agency -0.07 NA agency 0.11 Unstandardized structural equation model coefficients for staffing represent the percent change in urinary tract infection per a 1% change in the staffing measure.	RN agency NR NA agency 0.23
Castle, 2008[36]; Moderate; Cross-sectional;	OSCAR (2004); NA, LPN, and RN FTE per 100 residents. mean (SD): RN 11.7 (9.5), LPN 15.6 (8.6), NA 31.4 (9.9)	MDS, NH compare, AHRF, Survey (2004); Negative binominal regression models, coefficients (SE),	**Association between staffing measures and pressure ulcers among low and high risk populations:** Low Risk Population	NR	**Associations between staffing and urinary catheters left in:** Log NA staffing 0.913***(0.030)

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
6,005 free-standing NH (≥30 beds) national sample	Skill mix—RN/(LPN+NA), mean (SD): 0.25 (0.4) % FTE filled by agency staff, mean (SD): RN 8.7% (3.1), LPN 10.2% (3.4), NA 11.1% (4.6)	*p <.05, **p < .01, ***p < .001	Log NA staffing 0.932***(0.024) Log LPN staffing 0.944 (0.042) Log RN staffing 0.836* (0.082) Log staff mix 0.836* (0.086) <u>High Risk Population</u> Log NA staffing 0.940***(0.017) Log LPN staffing 0.856***(0.043) Log RN staffing 0.878**(0.051) Log staff mix 0.878** (0.053)		Log LPN staffing 0.925** (0.033) Log RN staffing 0.960 (0.063) Log staff mix 1.060 (0.061)
Flynn, 2010[32]; Moderate; Cross-sectional; 63 NH in New Jersey	NHC (2006); Mean minutes of care per resident day, mean (SD): RN 51 (29), LPN 43 (26), NA 135 (29), total nurse staffing 93 (44)	NHC (2006); Linear regression models for percentage of residents with pressure ulcers	*"There were no significant associations between any of these metrics of nurse staffing levels and other study variables."* (coefficients and other statistics NR)	NR	NR
Konetzka, 2008[18]; High;	OSCAR (1997 – 2000); RN HPRD, Skill mix measured as RN staffing hours as a proportion of total (RN, LPN & NA) staffing hours. Mean (SD)	MDS, Medicare Cost Reports (1997 – 2000); Logistic mixed model including an	**Risk of stage 2+ Pressure Sores in past 14 days (β (SE), (p value)).** Facility Fixed Effects Model:	**Resident Urinary Tract Infection** Fixed Effects Model Coefficient (SE) RN HRPD: 0.194 (0.106; p<0.10)	NR

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
Longitudinal; 1,366 NH (399,206 residents)	RN HPRD: 0.350 (0.291) Skill Mix: 0.117 (0.064) Instrumental variables: Indicator for when a facility implemented Medicare a Prospective Payment System and percent of residents in a nursing home with Medicare payer source in the baseline year (1997)	instrumental variable using the introduction of the Prospective Payment System (PPS) for Medicare payment in nursing homes, case mix adjusted	RN HPRD -0.222 (0.123) Skill Mix 0.632 (0.424) Instrumental Variable, Medicare PPS Model: RN HPRD -3.006* (0.515) Skill Mix -0.0009 (0.254) Instrumental Variable PPS w/residuals: RN HPRD -3.002* (0.515) Skill Mix 0.045 (0.437) *p<0.01	Skill Mix: -0.504 (0.352;p=NR) Two-stage least squares Coefficient (SE) RN HRPD: -1.528 (0.410; p<0.001) Skill Mix: -1.634 (0.525;p<0.0-1) Two-stage residual inclusion Coefficient (SE) RN HRPD: -1.556 (0.411; p<0.001) Skill Mix: -1.662 (0.495;p<0.001)	
Lee, 2014[28]; Moderate; Cross-sectional; 195 free-standing NH in Colorado	OSCAR (2000); RN HPRD Mean (SD) [Range]: 0.6 (0.2) [0.2-1.6] Estimated RN staffing using 2 instrumental variables (percent of the population over 65 and percent of females in workforce)	MDS (2000); Ordinary least squares regression model for rates outcomes among NH residents, also instrumental variable models (uses estimated RN staffing), case mix adjusted, coefficients (SE)	**Association between estimated RN staffing and pressure ulcers in low-risk residents, β (SE), (p value)** β = -11.272 (SE=5.026), (p<0.05)	**Percent of Residents with Urinary Tract Infection** 2-stage least squares regression beta coefficient RN HPRD: 3.090 (SE=4.017; p-value=NR). Non-Instrumental Variables Estimate: NR	**Association between RN HPRD and catheter left in, β (SE), (p value)** β = -0.684 (SE=1.883), (p-value NR) *results reported as non-significant

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
Lin, 2014[27]; Moderate; Longitudinal; 3,275 NH national sample	OSCAR (1999 and 2003); Includes full-time, part-time, and contract nurses Mean (SD) RN: 0.338 (0.316) NA: 2.438 (0.589) LN: 1.101 (0.550) LPN: 0.759 (0.399)	AHRF, Census (1999 and 2003); Two stage model with an instrumental variable predicting the change in nurse staffing after a policy change with required staffing levels was included in the model	**Association between predicted change in staffing after policy change and the fraction of residents with pressure ulcers (β (SE))** Distance RN 0.041** (0.021) Distance NA 0.0007 (0.006) * P value < .10, **P value < .05, ***P value < .01	NR	NR
Orth, 2021[42]; Moderate; Cross-sectional; 14,618 NH national sample (191,435 residents with dementia who died in 2017)	Nursing Home Compare (2018) and LTCfocus; HPRD, mean (SD): total 3.8 (0.7) Skill mix—RN/total staffing, mean (SD): 0.16 (0.07)	MDS (2018); Mixed-effects logistic models for odds of resident with pressure ulcers at time of death, case mix adjusted and stratified analyses for severity of dementia, OR (95% CI), p-values	**Total staffing hours per day (10-min increments) and pressure ulcers at time of death, stratified by dementia severity:** mild: 1.00 (0.98, 1.01), p=0.50 moderate: 1.00 (0.99, 1.01), p= 0.50 severe: 0.99 (0.98, 1.01), p=0.07 **Skill mix and pressure ulcers at time of death, stratified by dementia severity:** mild: 0.98 (0.85, 1.12), p=0.75	NR	NR

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
			moderate: 0.93 (0.85, 1.02), p=0.12) severe: 0.91 (0.82, 1.00), p= 0.048		
Temkin-Greener, 2012[30]; Moderate; Cross-sectional; 162 NH in New York (20,929 residents with stays ≥90 days and impaired with bed mobility or transfer, comatose or malnourished)	Survey, study specific (2006-2007); HPRD, mean (SD): RN 0.6 (0.2), LPN 0.8 (0.3), NA 2.3 (0.4), total staffing NR	MDS (2006 – 2007); Generalized estimating equations were used after risk-adjusted outcomes were identified, case mix adjusted	**Association of nurse staffing (HPRD) with pressure ulcers, (OR (p value)).** Total staffing 1.107 (p = 0.615)	NR	NR
Trinkoff, 2013[29]; Moderate; Cross-sectional;	NNHS (2004); Total nurse staffing HPRD, dichotomized as ≥ 5.0 vs. <5.0 (88% NH) Skill mix—(RN+LPN)/(RN+LPN+NA) Mean 34% (SD, NR)	MDS (2004); Logistic regression (NH >75th percentile in outcome rate), separate models for NA or licensed nurse (RN+LPN) turnover as main	**Pressure ulcer in low and high risk residents:** <u>NA turnover model</u> high risk: Staffing 1.01 (0.56, 1.82) Skill mix 1.02 (0.99, 1.05) low risk:	**Urinary Tract Infection** <u>NA turnover model</u> Staffing 0.77 (0.40, 1.47) Skill Mix 1.02 (1.00, 1.04) <u>Licensed nurse turnover model</u> Staffing 0.68 (0.37, 1.27)	<u>NA turnover model</u> Staffing 0.43 (0.20, 0.93) Skill mix 1.01 (0.98, 1.03) <u>Licensed nurse turnover model</u> Staffing 0.41 (0.19, 0.88) Skill mix 1.02 (0.99, 1.03)

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
1,142 NH national sample		predictor, OR (95% CI)	Staffing 1.21 (0.58, 2.53) Skill mix 1.02 (0.98, 1.05) <u>Licensed nurse turnover model</u> High risk: Staffing 1.18 (0.66, 2.12) Skill mix 1.02 (0.99, 1.04) low risk: Staffing 0.80 (0.38, 1.66) Skill mix 1.02 (0.98, 1.05)	Skill Mix 1.02 (1.00, 1.04)	
Trivedi, 2012[79]; Moderate; Longitudinal; 308 NH in Oregon, Wisconsin, and Pennsylvania that reported norovirus outbreak	NHC (2009-2010) HPRD, mean (IQR): RN 0.8 (0.7-1.0)	MDS and CDC National Outbreak Reporting System (2009-2010) Mixed effects Poisson regression models to compare NH resident hospitalizations and mortality during norovirus outbreak and non-outbreak periods, stratified by RN HPRD (<0.75, 0.75-0.95, and >0.95)	NR	<u>Hospitalization RR (95%CI)</u> RN HPRD: <0.75 1.10 (1.03-1.19), p=0.006 0.75-0.95 1.13 (1.05-1.21), p=0.001 >0.95 1.04 (.97-1.11), p=0.300 <u>Mortality RR (95%CI)</u> RN HPRD: <0.75 1.26 (1.14-1.40), p<0.001 0.75-0.95 1.01 (0.91-1.12), p=0.87 >0.95 1.06 (0.94-1.19), P\p=0.32	NR

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Pressure Ulcers	Nursing Home-Associated Infections	Urinary Catheters
Uchida-Nakakoji, 2015[40]; High; Longitudinal; 84 VA NH (CLCs) national sample	VA payroll data (2003-2008); HPRD, mean (SD): Total nurse staffing 4.6 (1.2) Skill Mix—each type/total staffing, mean (SD): RN 31% (10%), LPN 26% (10%), NA 42% (13%)	MDS (2003-2008) Negative binomial regression models for total counts per NH (UTI, pneumonia and pressure ulcers), case mix adjusted	**Composite of UTI, pneumonia, and pressure ulcers** IRR (SE) Total staffing: 1 (0.01), p=0.985 Percent RN: 1.233 (0.232), p=0.264 Percent NA: 1.160 (0.180), p=0.336		NR

Abbreviations. AHRF=Area Health Resource File; CDC=Centers for Disease Control and Prevention; CI = confidence interval; CLC=Community Living Center; HPRD = hours per resident day; IQR= Interquartile range; IRR = incident rate ratio; NH= Nursing Home; NHC=Nursing Home Compare (CMS data); NNHS = National Nursing Home Survey; OR = Odds ratio; PBJ = Payroll based journal; PPS = Prospective Payment System; RR=Rate ratio; SEM = Structural Equation Modeling; UTI=urinary tract infection; VA=Department of Veterans Affairs

Appendix Table F-2. Nursing Home Staffing Associations with COVID-19

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	COVID-19 Results
Domi, 2021[48]; High; Repeated time series; 2,501 NH in 17 states (had vaccine clinics as part of Pharmacy Partnership for Long Term Care Program)	PBJ (2020) RN HPRD in 3 categories, %NH in categories across 3 cohorts: ≤0.449—23-30% (low staffing) 0.499–0.987—51-55% (reference) >0.987—51-55% (high staffing)	NHSN (2021) Zero-inflated negative binomial mixed effects regression for number of resident cases and number of resident deaths (due to COVID-19), IRR	**Resident COVID-19 Cases:** RN low staffing (≤0.499) 0.92, p=0.47 RN high staffing (>0.987) 0.84, p=0.16 **Confirmed Resident COVID-19 Deaths:** RN low staffing (≤0.499) 1.05, p=0.73 RN high staffing (>0.987) 0.68, p=0.02
Gorges, 2020[49]; High; Cross-sectional; 13,167 NH national sample (85% of facilities that had reported data to CMS COVID-19 Nursing Home dataset)	PBJ (2020) Case-mix adjusted HPRD, mean (SD NR): RN 0.7, LPN 0.9, NA 2.3, total nurse staffing 3.9 Skill mix—RN/total nurse staffing, mean (SD NR): 17.9	CMS COVID-19 Nursing Home dataset (2020) 2 separate models per each outcome: 1) RN, LPN, and NA staffing 2) Total nurse staffing and skill mix (all staffing categorized in 3 quantiles—low, middle-reference, and high) 3 NH outcomes: • Any COVID-19 cases (logistic regression) • Any COVID-19 outbreak (logistic regression) • Count of COVID-10 deaths in NH with any cases (hurdle	**Any COVID-19, OR (SE)** / **COVID-19 Outbreak, OR (SE)** / **Deaths, marginal effect (SE)** Model 1 Low RN 0.838 (0.069)* 0.874 (0.070) -0.415 (0.196)* High RN 1.341 (0.088)** 1.031 (0.079) -0.243 (0.217) Low LPN 0.975 (0.052) 0.847 (0.073) -0.702 (0.203) High LPN 1.083 (0.066) 1.064 (0.081) -0.183 (0.197) Low NA 0.887 (0.058) 1.001 (0.078) -0.34 (0.184) High NA 1.027 (0.071) 0.790 (0.058)* -0.981 (0.229)** Model 2 Low total 0.827 (0.071)* 0.924 (0.073) -0.371 (0.186)* High total 1.153 (0.109) 0.822 (0.057)** -1.059 (0.229)** Low skill mix 0.887 (0.052)* 1.018 (0.062) -0.389 (0.207) High skill mix 1.218 (0.078)** 1.034 (0.069) -0.296 (0.195) *p<0.05; **p<0.01

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	COVID-19 Results
		negative binomial-2 regression) Models not adjusted for case mix	
Harrington, 2020[11]; High; Cross-sectional; 1,091 NH in California (272 with COVID-19 cases, 819 without)	PBJ (2019); HPRD, mean (SD): RN 0.6 (0.6), total staffing 4.3 (1.1)	LA County Department of Public Health, California Department of Public Health, and news organizations (March-May 2020) Logistic regression for NH having any COVID-19 cases, separate models for RN and total staffing, not adjusted for case mix, OR (95% CI)	**Any COVID-19 Cases** RN <0.75 vs. ≥0.75 HPRD: 2.086 (1.318, 3.301) Total staffing <4.1 vs. ≥4.1 HPRD: 1.269 (0.932, 1.72)
Li, 2020[39]; Moderate; Cross-sectional; 215 NH in Connecticut	NHC, PBJ (2019); HPRD, mean (IQR): RN 0.7 (0.5-0.8), total staffing 3.7 (3.3-4.0)	News organizations, state agency data (2019-2020); Logistic regression for NH having any confirmed case or death, and linear model (Poisson distribution) for number of cases or deaths in NH with any, case mix adjusted	**Resident COVID-19 Cases** Any cases, OR (95% CI) RN staffing, per 0.33 HPRD: 0.81 (0.41,1.60), p=0.54 Count of cases, IRR (95% CI) RN staffing, per 0.33 HPRD: 0.78 (0.68, 0.89), p=<0.001 **Resident COVID-19 Deaths** Any deaths, OR (95% CI) RN staffing, per 0.33 HPRD: 0.62 (0.29, 1.35), p=0.229 Count of cases, IRR (95% CI) RN staffing, per 0.33 HPRD: 0.74 (0.55, 1.00), p=0.047

Abbreviations. CI = confidence interval; HPRD = hours per resident day; IRR = incident rate ratio; IQR=Interquartile range; LPN=Licensed practical nurse; NA=Nursing assistant; NH= Nursing Home; NHC=Nursing Home Compare (CMS data); OR = Odds ratio; PBJ = Payroll based journal; RN=Registered nurse; SD=Standard deviation; SE=Standard error

Appendix Table F-3. Nursing Home Staffing Associations with Resident Pain and Functioning Outcomes

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Moderate to Severe Pain	Worse Functioning
Arling, 2007[51]; High; Longitudinal; 105 NH (5,242 residents) in Colorado (1998), Indiana (1999), Mississippi (2001), and Minnesota (2004)	Observation and staff self-report (1998-2004); Resident-specific time (RST; hands-on care or administrative tasks for individual residents) HPRD, mean (SD)—RN 0.19 (0.33), LPN 0.34 (0.32), NA 1.29 (0.82) Total direct care (includes RST and tasks for general maintenance or care of unit) HPRD, mean (SD)—licenses staff (RN + LPN) 0.47 (0.23), descriptives NR separately for RN, LPN, or NA	MDS (1998-2004); GLM with logit link (presence of ADL decline), case-mix adjusted, coefficients reported with significant p-values marked (otherwise p-values NR)	NR	Decline in ADL (bed mobility, transfer, eating, toileting) in MDS at baseline (closest to staffing data) and 90 days later: <u>RST</u> RN 0.09 LPN 0.13 NA 0.42 (p<.001) <u>Total direct care</u> RN -0.27 LPN 0.25 NA NR
Castle, 2015[26]; Moderate; Cross-sectional; 3,939 free-standing NH, ≥30 beds, national sample	NHA survey (2008); FTE per 100 residents (not including agency staff), mean (SD): RN 11.7 (9.3), LPN 14.6 (8.4), NA 30.4 (9.5) % FTE filled by agency staff, mean (SD): RN 9.7% (3.3), LPN 11.2% (3.5), NA 12.1% (4.2) Skill mix—RN/(LPN+NA), mean (SD): 0.25 (0.4)	NH Compare (2008); Negative binomial regression (counts of cases per NH), case-mix adjusted, IRR (95% CI)	Residents (long-stay) with moderate-severe pain: <u>FTE</u> RN 1.02 (0.99, 1.13) LPN 0.98* (0.89, 0.99) NA 0.89* (0.83, 0.98) <u>% agency</u> RN 1.09* (1.02, 1.14) LPN 1.01* (1.00, 1.10) NA 1.05 (0.99, 1.18)	NR

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Moderate to Severe Pain	Worse Functioning
			Staff mix 0.92*** (0.88, 0.98) *p < 0.05; **p<0.01; ***p <0.001	
Castle, 2011[31]; Moderate; Longitudinal; 2,839 free-standing NH, ≥30 beds, national sample	NHA survey (2003-2007); FTE per 100 residents (not including agency staff), mean (SD): RN 11.7 (9.3), LPN 14.6 (8.4), NA 30.4 (9.5) % FTE filled by agency staff, mean (SD): RN 9.7% (3.3), LPN 11.2% (3.5), NA 12.1% (4.2) Skill mix—RN/(LPN+NA), mean (SD): 0.25 (0.4)	NH Compare (2003-2007); GMM with Arellano-Bond estimator (change in % residents with outcome, case-adjusted measure), coefficients (SE)	Residents (long-stay) with moderate-severe pain: <u>FTE (per increase of 1)</u> RN -0.53*(0.28) LPN -0.15** (0.05) NA -0.46**(0.17) <u>% agency (per decrease of 1%)</u> RN -0.31***(0.11) LPN -0.19 (0.08) NA -0.32*(0.02) Skill mix, per increase of 1% -0.15*** (0.03) Significant at: * 0.05; ** 0.01; ***0.001	NR
Castle, 2010[35]; Moderate; Cross-sectional; 2,840 free-standing NH, ≥30 beds, national sample	NHA survey (2005); FTE per 100 residents (not including agency staff), mean (SD): RN 12.2 (8.2), LPN 12.5 (6.5), NA 25.8 (7.0) Agency staff FTE per 100 beds, mean (SD): RN 1.6 (1.2), LPN 2.9 (1.9), NA 6.9 (3.4)	NH Compare (2005); SEM path analysis (% residents with outcome, case-adjusted for pain but not functioning), path coefficients p≤0.05 were reported (otherwise NR)	Residents with moderate-severe pain: **Long-stay** / **Short-stay** <u>FTE</u> RN -0.17 / -0.06 LPN -0.14 / -0.06 NA -0.06 / -0.01 <u>Agency FTE</u> RN NR / NR LPN NR / NR NA 0.55 / 0.10	Residents with worse functioning: **ADL** / **Mobility (in room)** <u>FTE</u> RN -0.06 / -0.06 LPN -0.09 / -0.05 NA -0.06 / 0.27 <u>Agency FTE</u> RN NR / 0.00 LPN NR / NR NA 0.38 / 0.46

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Moderate to Severe Pain	Worse Functioning
Castle, 2008[36]; Moderate; Cross-sectional; 6,005 free-standing NH, ≥30 beds, national sample	NHA survey (2005-2006), staffing data for 2004; FTE per 100 residents (not including agency staff), mean (SD): RN 11.7 (9.5), LPN 15.6 (8.6), NA 31.4 (9.9) % FTE filled by agency staff, mean (SD): RN 8.7% (3.1), LPN 10.2% (3.4), NA 11.1% (4.6) Skill mix—RN/(LPN+NA), mean (SD): 0.25 (0.4)	NH Compare (2004); Negative binomial regression (count of events per NH), case adjustment NR, coefficients (SE)	Residents with moderate-severe pain: **Long-stay** **Short-stay** Log FTE RN 0.771** (0.083) 0.844***(0.052) LPN 1.121 (0.099) 0.867**(0.049) NA 0.954***(0.012) 0.478***(0.106) Log agency % RN 1.184* (0.114) 1.012 (0.030) LPN 0.920 (0.149) 1.019 (0.192) NA 1.081*** (0.030) 1.055*** (0.021) Log skill mix 0.773** (0.082) 0.958 (0.040) *p <0.05; **p <0.01; ***p <0.001.	NR
Castle, 2007[33]; Moderate; Cross-sectional; 1,071 NH in Missouri, Texas, Pennsylvania, New York, Connecticut,	NHA survey (2003); FTE per 100 residents (not including agency staff), mean (SD): RN 14.7 (9.3), LPN 16.6 (8.1), NA 33.4 (10.1) % FTE filled by agency staff, mean (SD): RN 7.7% (12.7),	NH Compare (2003); Negative binomial regression (% residents with outcome, case-adjusted for pain and mobility but	Residents with moderate-severe pain: **Long-stay** **Short-stay** Log FTE RN 0.960 (0.136) 1.247 (0.191) LPN 0.987 (0.152) 0.827 (0.143) NA 1.131 (0.253) 0.798	Residents with worse functioning: **ADL** **Mobility (in room)** log FTE RN 0.759**(0.064) 0.826**(0.062) LPN 1.123 (0.097) 1.024 (0.063) NA 1.046 (0.148) 0.946 (0.126) Log agency %

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Moderate to Severe Pain	Worse Functioning
and New Jersey (2 states from each tertile for staff turnover)	LPN 1.9% (3.9), NA 20.2% (18.9)	not ADL), coefficients (SE)	(0.333) <u>Log agency %</u> RN 1.077* (0.033) 1.004 (0.046) LPN 1.034 (0.028) 0.914* (0.038) NA 1.055 (0.059) 1.260** (0.079) Significant at: * 0.05; ** 0.01	RN 1.035* (0.016) 1.054**(0.014) LPN 1.011 (0.017) 1.006 (0.013) NA 1.068* (0.030) 1.058* (0.027) Significant at: * 0.05; ** 0.01
Trinkoff, 2013[29]; Moderate; Cross-sectional; 1,142 NH, national sample	National NH Survey (2004, by CDC); Total staffing (RN+LPN+NA) HPRD, dichotomized at < 5.0 or ≥5.0, 88% NH had <5.0 Skill mix—(RN+LPN)/(RN+LPN+NA), mean 34% (SD NR)	MDS (2004); Logistic regression (NH >75th percentile in outcome rate), separate models for NA or licensed nurse (RN+LPN) turnover as main predictor, OR (95% CI)	Residents with moderate-severe pain (whether long-stay and/or short-stay NR): <u>NA turnover model</u> Total staffing 0.74 (0.37, 1.48) Skill mix 1.00 (0.98, 1.02) <u>Licensed nurse turnover model</u> Total staffing 0.57 (0.29, 1.11) Skill mix 1.00 (0.98, 1.02)	NR

Abbreviations. ADL=Activities of daily living; CI=confidence interval; FTE=Full-time equivalent; GLM=Generalized linear model; GMM=Generalized method of moments; HPRD=Hours per resident day; IRR=Incident rate ratio; LPN=Licensed practical nurse; MDS=Minimum data set; NA=Nursing assistant; NH=Nursing homes; NHA=Nursing home administrator; NR=Not reported; OSCAR=Online Survey Certification and Reporting; RN=Registered nurse; SD=Standard deviation; SE=Standard error; SEM=Structural equations model

Appendix Table F-4. Nursing Home Staffing Associations with Quality of Life

Author, Year; Quality; Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Quality of Life (QoL) Results
Abrahamson, 2013[54]; Moderate; Cross-sectional; 388 NH in Minnesota (random sample of residents)	Minnesota Department of Human Services Statistical and Cost Report (2007) HPRD, mean (SD): RN 0.3 (0.3), LPN 0.7 (0.2), NA 2.3 (0.4)	Resident Quality of Life and Satisfaction with Care Survey (2007), composite score of items from 5 domains (meaningful activities, autonomy, privacy, relationships, and individuality) Mixed effects linear models for composite QoL score, adjusted for case mix, coefficients (SE) and p-values reported	HPRD — QoL Composite RN — 1.95 (1.82), p=0.285 LPN — 0.90 (1.26), p=0.478 NA — 1.97 (0.74), p=0.008
Shin, 2014[53]; Moderate; Cross-sectional; 8 NH (142 long-term residents ≥65 years old) in western New York	OSCAR (2010) HPRD, mean (SD): RN 0.7 (0.2), LPN 0.9 (0.1), NA 2.2 (0.2) Skill-mix—RN/(LPN + NA), mean and SD not reported	Self-reported Quality of Life instrument (2010), 11 domains (comfort, functional competency, privacy, meaningful activity, autonomy, food enjoyment, spiritual well-being, security, individuality, dignity, relationships, and security) and summary score Mixed effects linear models for QoL domains and summary score, adjusted for case mix, t-values reported	HPRD — QoL Summary Score RN — -5.23 LPN — -3.57 NA — 1.304 Skill Mix — -0.062 None were marked as statistically significant.
Shippee, 2015[52]; Moderate; Longitudinal; 369 NH in Minnesota (random sample of residents)	Minnesota Department of Human Services (2007-2010) HPRD, mean (SD): RN 0.4 (0.2), LPN 0.7 (0.2), NA 2.4 (0.5)	Resident Quality of Life and Satisfaction with Care Survey (2007-2010), 6 domains (environment, personal attention, food, engagement, negative mood, positive mood) and summary score Mixed effects linear models for QoL domains and summary score, adjusted for case mix, coefficients reported	HPRD — QoL Summary Score RN — 2.51* LPN — 0.09 NA — 0.22 *p<0.01

Abbreviations. FTE=Full-time equivalent; HPRD=Hours per resident day; LPN=Licensed practical nurse; NA=Nurse assistant; NH=Nursing home; OSCAR=Online Survey Certification and Reporting; QoL=Quality of life; RN=Registered nurse; SD=Standard deviation; SE=Standard error

Appendix Table F-5. Nursing Home Staffing Associations with Hospitalizations

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Hospitalization Results
Orth, 2021[42]; Moderate; Cross-sectional; 14,618 NH national sample (191,435 residents with dementia who died in 2017)	Nursing Home Compare (2018) and LTCfocus; HPRD, mean (SD): total 3.8 (0.7) Skill mix—RN/total staffing, mean (SD): 0.16 (0.07)	CMS MedPAR data (2016-2017); Mixed-effects logistic models for odds of resident with potentially avoidable hospitalization within last 90 days of life, case mix adjusted and stratified analyses for severity of dementia, OR (95% CI)	**Potentially Avoidable Hospitalizations within last 90 days:** <u>Mild dementia</u> Total staffing (per 10 mins) 1.00 (0.98, 1.01), p=0.58 Skill mix 0.86 (0.76, 0.98), p=0.022 <u>Moderate dementia</u> Total staffing (per 10 mins) 1.00 (0.99, 1.01), p=0.57 Skill mix 0.75 (0.68, 0.83), p<0.001 <u>Severe dementia</u> Total staffing (per 10 mins) 0.99 (0.98, 1.00), p=0.20 Skill mix 0.73 (0.64, 0.82), p<0.001
Thomas, 2014[43]; Moderate; Cross-sectional; 15,356 NH national sample (1,382,477 patients discharged from 3,683 hospitals to NH in 2007)	OSCAR (2006) HPRD, mean (SD): RN 0.4 (0.7), LPN 0.8 (0.8), NA 2.3 (1.1)	Medicare Claims (2007) Cross-classified random effects models for linear probability of readmission within 30 days, case mix adjusted and nurse staffing variables standardized, estimates (SE)	**30-day Readmission:** RN −0.0019 (0.0009), p=0.03 LPN 0.0007 (0.0009), p=0.47 CNA −0.0014 (0.0007), p=0.05
Xing, 2013[44]; Moderate; Longitudinal;	CMS Provider of Service, LTCFocus (2006-2007); HPRD, mean (SD): total nurse staffing 3.3 (1.0)	CMS Chronic Care Data Warehouse (2006-2007); Logistic regression for nursing home having worse than average rates of potentially avoidable hospitalizations in the	**Potentially Avoidable Hospitalizations within last year:** Total staffing 0.94 (0.90–0.99), p=0.02 Skill mix, per 10% higher 0.92 (0.88–0.97), p=0.001

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Hospitalization Results
11,999 NH national sample (274,774 residents ≥ 65 years old who died in 2007)	Skill mix—RN/(LPN+NA), mean (SD): 0.11 (0.15)	last year of life, case mix adjusted, OR (95% CI)	
O'Malley, 2011[46]; High; Longitudinal; 67 NH in New York	OSCAR (1998-2004) RN FTE per bed, mean (SD): 0.06 (0.04)	New York State agency data (1998-2004) Accelerated failure time models for time to first hospitalization and time between repeat hospitalizations, case mix adjusted, coefficients	**Time to First Hospitalization:** 0.11, p=0.10 **Time between Hospitalizations**: 0.03, p=0.67
Xu, 2021[47]; Moderate; Longitudinal; 14,600 free-standing NH (≥20 beds), national sample	CASPER (2011-2013) HPRD, mean (SD): total nurse staffing 3.6 (1.0) Skill mix—RN/(RN+LPN), mean (SD): 0.33 (0.19)	Medicare Claims (2011-2013); Generalized Estimating Equations model for rates of hospitalizations per NH per quarter, case mix adjusted, coefficient (SE)	**Hospitalizations rates per quarter:** Total staffing 0.07 (0.06) Skill mix -0.11 (0.04)* *p<0.05

Abbreviations. CI = confidence interval; CASPER= Certification And Survey Provider Enhanced Reporting system; CMS=Centers for Medicare and Medicaid Services; HPRD=Hours per resident day; LPN=Licensed practical nurse; MedPAR=Medicare Provider Analysis and Review File; NA=Nursing assistant; NH= Nursing Home; NNHS = National Nursing Home Survey; OR = Odds ratio; OSCAR= Online Survey Certification and Reporting system; RN=Registered nurse; SD=standard deviation; SE=standard error

Appendix Table F-6. Nursing Home Staffing Associations Deficiency Citations

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Outcome Definition; Analytic Strategy	Associations with Deficiency Citations
Castle, 2011[55]; Moderate; Cross-sectional; 3,941 free-standing NH, ≥30 beds, national sample	NHA survey (2008), staffing data for 2007; FTE per 100 residents (not including agency staff), mean (SD): RN 10.6 (9.2), LPN 14.5 (8.1), NA 30.1 (9.2) % FTE filled by agency staff, mean (SD): RN 10.9% (3.1), LPN 12.1% (3.6), NA 13.5% (4.0) Skill mix—RN/(LPN+NA), mean (SD): 0.23 (0.5)	OSCAR (2007); Quality of care deficiency citations—sum of 25 citations (F-tags 309-353) addressing ADL and specific care needs, adequate nutrition, medication errors, etc.; Negative binomial regression (counts of deficiency citations per NH), case-mix adjusted, IRR (95% CI)	FTE RN 0.93 (0.80, 1.02) LPN 0.77 (0.56-1.00) NA 1.01 (0.85-1.05) % agency RN 1.18 (0.91-1.25) LPN 1.05* (1.00-1.11) NA 1.11** (1.07-1.21) Staff mix 0.86** (0.81-0.94) Statistically significant at: *p = 0.05 or better; **p=0.01 or better
Castle, 2011[56]; Moderate; Longitudinal; 14,934 NH, national sample	OSCAR (2000-2007); FTE per resident, mean (SD) for NH without or with citation in 2000: **No citation** (1,828 NH) / **Citation** (12,372 NH): RN 0.07 (0.11) / 0.06 (0.08); LPN 0.12 (0.09) / 0.12 (0.08); NA 0.32 (0.14) / 0.33 (0.12)	OSCAR (2000-2007); Deficiency citation F-441 for infection control and hand hygiene; GEE with logit link (NH received citation or not), case-mix adjusted, OR (95% CI)	RN 0.89 (0.84, 0.97)*** LPN 0.92 (0.87, 0.99)* NA 0.91 (0.89, 0.98)*** Statistically significant at: *p = 0.05 or better; **p=0.01 or better; ***p=0.001 or better
Castle, 2011[57]; High; Longitudinal;	OSCAR (2000-2007); FTE per resident, mean (SD) for NH without any citations: RN 0.07 (0.11), LPN 0.12 (0.09), NA 0.31 (0.14)	OSCAR (2000-2007); Deficiency citations for care safety—any of 5 F-tags: F-332 (medication error rates), F-333 (residents free from medication errors), F-389 (physician available for emergency care), F-431 (drug labeling and storage), F-441 (infection control and hand hygiene);	FTE/100 beds RN 0.95 (0.92, 0.97)** LPN 1.02([1.00, 1.05)* NA 1.01 (0.99,1.02) Statistically significant at: *p = 0.05 or better; **p=0.01 or better; ***p=0.001 or better

Author, Year; Quality Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Outcome Definition; Analytic Strategy	Associations with Deficiency Citations
14,934 NH, national sample		GEE with logit link (NH received citation or not), case-mix adjusted, OR (95% CI)	
Lerner, 2004[58]; Moderate; Cross-sectional; 1,151 NH, national sample	National NH Survey (2004, by CDC); Total staffing (RN+LPN+NA) HPRD, dichotomized at < 5.0 or ≥5.0, 88% NH had <5.0 Skill mix—(RN+LPN)/(RN+LPN+NA), mean 34% (SD NR)	OSCAR (2004); Quality of care deficiency citations—sum of 25 citations (ADL, continence, pressure ulcers and range of motion); Logistic regression (NH >75th percentile in # of citations), main predictors NA and licensed nurse (RN+LPN) turnover, no case-mix adjustment, OR (95% CI)	Total staffing 1.03 (0.63, 1.69) Skill mix 0.99 (0.97, 1.01)
Temkin-Greener, 2007[59]; Moderate; Cross-sectional; 162 NH in New York, ≥50 beds, open ≥2 years, state-level sample	NH Compare (year NR); HPRD, mean (SD): RN 0.61 (0.23), LPN 0.83 (0.25), NA 2.31 (0.40)	OSCAR (2006-2007); Quality of care deficiency citations—Sum of 26 citations, whether any G-L in seriousness; Total citations—linear regression, standardized coefficients G-L citations—logistic regression, OR, p-value	**Total Citations** **Any G-L Citations** Coeff, p-value OR, p-value RN -0.253, 0.005 0.792, 0.395 LPN -0.106, 0.239 0.837, 0.507 NA 0.017, 0.746 1.353, 0.191

Abbreviations. ADL=Activities of daily living; CI=confidence interval; FTE=Full-time equivalent; GLM=Generalized linear model; GMM=Generalized method of moments; HPRD=Hours per resident day; IRR=Incident rate ratio; LPN=Licensed practical nurse; MDS=Minimum data set; NA=Nursing aide or assistant; NH=Nursing homes; NHA=Nursing home administrator; NR=Not reported; OR=Odds ratio; OSCAR=Online Survey Certification and Reporting; RN=Registered nurse ; SD=Standard deviation ; SE=Standard error; SEM=Structural equations model

Appendix Table F-7. Nursing Home Staffing Associations with Receipt of Antipsychotics, Falls, Discharge to Community, and Mortality

Author, Year; Quality; Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Results
Use of Antipsychotic Medications			
Bowblis, 2010[60]; Moderate; Repeated time series; 14,743 NH national sample	OSCAR (2000-2005); HPRD, mean (SD): RN 0.3 (0.3), LPN 0.7 (0.4), NA 2.0 (0.7)	MDS (2000-2005); Mixed effects linear regression for rates of antipsychotics use in NH, case mix adjusted, coefficients (SE)	**Associations between HPRD and antipsychotic use:** RN: 0.16 (0.17) LPN: 0.28 (0.13)* CNA: 0.13 (0.13)* *significant at 5%
Lee, 2014[28]; Moderate; Cross-sectional; 195 free-standing NH in Colorado	OSCAR (2000); RN HPRD Mean (SD) [Range]: 0.6 (0.2) [0.2-1.6]	MDS (2000); Ordinary least squares regression model for rates of antipsychotics use in NH, case mix adjusted, coefficients (SE)	**Association between RN HPRD and antipsychotic use:** 0.176 (4.5) p-value NR but results not highlighted as significant
Falls			
Leland, 2012[62]; High; Cross-sectional; 15,350 NH national sample (385,545 residents with first NH admission in 2006)	OSCAR (2006) HPRD, mean (SD): nurse (RN + LPN) 1.1 (0.5), NA 2.2 (0.8)	MDS (2006) Fixed effects panel regression	**Falls within 30 days after admission to NH:** OR (95% CI) Nurse: 1.01 (0.98-1.04) NA: 0.97 (0.95–0.99)
Livingstone, 2019[61]; Moderate;	NHC and CASPER (2013-2016)	NHC (2013-2016)	**Percent of long-term care residents experiencing ≥1 fall with bone fracture, joint dislocation, closed head injury, subdermal**

Author, Year; Quality; Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Results
Repeated time series; 12,352 NH national sample (≥30 residents and in operation for all years between 2013-2016)	HPRD, mean (SD): RN 0.5 (0.4), LPN 0.8 (0.3), NA 2.3 (0.6)	Multilevel random effects regression	**hematoma, or altered consciousness (outcome reverse coded; higher is better).** Coefficient (Robust SE) RN HPRD: 0.16* (0.06; p<0.05) LPN HPRD: 0.07 (0.05; p=NR) NA HPRD: 0.01 (0.03; p=NR)
Discharge to Community			
Warren[63]; High; Cross-sectional; 68 NH contracting with SeniorMetrix (6,865 residents with lengths of stay ≤100 days)	OSCAR[a] (2002) total staffing (RN + LPN + NA) HPRD, dichotomized as <3.5 (34% of NH) or ≥ 3.5 (66%)	SeniorMetrix, a private company assisting NH with quality improvement for residents with Medicare Advantage (2002); Multiple logistic regression Staffing and/or skill mix were the primary or secondary focus of the analysis.	For patients in facilities with **a nursing staff level of ≥3.5 hours per resident per day, the odds of being discharged to the community** were 1.53 (95% CI, 1.29–1.80) times greater than for patients in facilities with a lower nursing staff level.
Mortality			
Tong, 2011[64]; Moderate; Longitudinal; 612 NH in California with <3.2 total nurse staffing HPRD in 1999	California Office of Statewide Health Planning and Development (1995–2002) HPRD, mean (SD): 1995-1999 / 2000-2002 RN 0.3 (0.2) / 0.3 (0.2) LPN 0.5 (0.2) / 0.6 (0.2) NA 2.0 (0.4) / 2.3 (0.3) Total 2.8 (0.6) / 3.1 (0.4)	California Office of Statewide Health Planning and Development (1995–2002) Ordinary least squares regression for number of residents who died per NH, also 2-stage instrumental variable model, not adjusted for case mix, coefficients (SE)	**Association between total nurse staffing and NH resident death:** Ordinary least squares: 0.008 (0.646) Instrumental var: -6.137 (2.341)* *significant at 1% level

Author, Year; Quality; Study design; Sample	Nurse Staffing: Data Sources (Year); Definition & Descriptives	Outcome Data Sources (Year); Analytic Strategy	Results
	Estimated nurse staffing using instrumental variable approach (gap between actual total staffing and required 3.2 HPRD, mandated in 2000)		

Abbreviations. AHRF=Area Health Resource File; CI=confidence interval; FTE=Full-time equivalent; HPRD=Hours per resident day; LPN=Licensed practical nurse;; MDS=Minimum Data Set; MH=mental health; NA=Nurse assistant; NH=Nursing home; NHC=Nursing Home Compare; NR=Not reported; NS=Not significant; OR=Odds ratio; OSCAR=Online Survey Certification and Reporting; RN=Registered nurse; SD=Standard deviation; SE=Standard error

[a] Reported as Medicare data in study but description (uses NH self-reports and state surveys) consistent with OSCAR data collected by CMS