This is a repository copy of *The Relationship Between Registered Nurses and Nursing Home Quality: An Integrative Review (2008-2014)*.

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Table 10

Summary of Reviewed Studies

Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Alexander -2008	510 NHs in Missouri	Nursing Home Compare files 2004	Cross-sectional	RN HPRD Grouped low (<0.30) medium (0.30-0.44) High (>0.44)	14 long- and 5 short-stay Quality Measures (Process and Outcome)	With RN HPRD < 0.30, residents with moderate-severe pain increased	negative
						With RN HPRD <0.45 minutes or less, fewer pressure ulcers than nursing homes reporting higher RN staffing	positive
						As RN staffing increased, licensed nurses spent more time with residents	positive

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Castle 2008	8,023 NHs	OSCAR Primary data ARF (2005-2006)	Cross-sectional	FTE RNs/ 100 residents	19 quality of care deficiencies	Average RN turnover 46.10% Average DON turnover 39.40%	
					Sum of RN terminations for 6 months/ Sum of established positions	Low NA turnover associated with high RNs	negative
						Low RN turnover associated with high RN staffing levels	negative
					RN vacancy rates	Low RN turnover associated with high RN staffing lev;	negative
					(Outcomes)	Low DON turnover associated with low turnover RNs,LPNs,NAs	positive
						High RN turnover associated with high number deficiencies; High RN staff associated with low RN staffing;	positive
						Low RN turnover and deficiencies not significantly associated	not significant

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Castle and Engberg 2008	6,005 NHs	Primary data OSCAR ARF Nursing Home Compare	Cross-sectional	FTE RNs/ 100 residents RNs/ (NA and LPNs) % FTE positions filled by agency RNs in past year	11 long-stay quality measures; 3 short stay quality measures; %RNs work 5 yrs. or more (Process and outcome)	In 5 of 6 RN staffing coefficients, higher RN staffing associated with better quality High RN stability associated with low restrain use; high professional staff assoc.with low use use; high RN and NA agency staffing associated with high restraint use	positive negative negative positive
Castle and Engberg 2008	1,071 NHs	Primary data Nursing home compare	Cross-sectional	FTE agency RNs/100 beds FTE agency RNs/100 beds	14 QMS (Process and Outcomes)	An additional agency RN improves quality; An additional RN does not; Regular RN staff and agency NAs interact positively There is a positive interaction between agency RNs and regular LPNs	positive not significant positive positive

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Decker 2008	4.086 Medicare stay discharged residents	National Nursing Home Survey 1997 and 1999	Cross-sectional	RN daily hours/bed	Predictors of discharge status (6 types of discharges) (Outcome)	Increase in RN staffing decreased the probability of hospitalization by > 4% points; Higher RN staffing and PT staffing levels associated with shorter length of stay among recovered/ stabilized discharges	negative negative
Decker 2008	6,623 sample of total annual discharges for shorter and long stay in both residents admitted from hospital or not	1999 National Nursing Home Survey ARF	Cross-sectional	RN daily hours/bed RN FTEs/ RN + LPN + NA FTEs	Discharge of nursing home residents to hospital (Outcome)	For longer stay residents (>30 days) higher RN staffing levels in NHs reduced hospitalizations only for residents admitted from hospitals; Higher RN levels reduced hospitalization more than higher licensed nurse levels or skill mix; only among longer-stay residents not admitted from hospitals was RN staffing unrelated to hospitalizations	negative not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Dellefield 2008	24 MDS RNs from 20 states	Primary data	Qualitative	RN Minimum Data Set Coordinator Role		MDS training, reporting relationships, software used, quality and compliance cultures impact the RN's work role performance	
Feng (2008)	77,622 survey observations from 9,996 urban, free-standing NHs in 48 states	OSCAR ARF CMS regional wage index	Longitudinal	RN HPRD	RN staffing level in response to state Medicaid rate and case-mix reimbursement (Structural)	Overall increase in nursing staff; small significant decrease in RN HPRD	positive negative for RN HPRD

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Horn (2008)	1,376 nursing residents and 82 NHs in 23 states	National Ulcer Long-Term care Study MDS data Medical records Wage data Bureau of Labor Statistics	Cohort study	Average RN direct care time/resident day (10 minute increments)	Hospital-izatons, pressure ulcers, urinary tract infections (Outcomes)	For 100 bed long-stay NH with high risk nursing unit with less than 10 minutes RN/per resident day, increase in RN staffing to 30-40 minutes/resident day associated with annual net societal cost savings of > $319,000; nursing home total costs estimated to increase $199,507 for 100-bed, high risk home; staffing decreased 0.01 HPRD on average after introduction of case mix; reduced incidence of outcomes negative
Konetzka, Stearns, Park 2008	399,206 resident observations from freestanding nursing homes in Ohio, Kansas, Maine, Mississippi, South Dakota (1997-2000)	MDS resident quarterly observations falling within 120 days of annual OSCAR data point; OSCAR	Longitudinal	RN HPRD RN staffing hours as proportion of total nurse staffing hours	Pressure sore within 14 days; UTI within last 30 days (Outcomes)	With endogeneity of staffing increases, greater RN staffing significantly decreased likelihood of both adverse events; Increased skill mix decreased incidence of UTIs negative negative

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Siegel (2008)	31 nursing home staff in 3 NHs	Primary data	Qualitative	RN role RN supervisor Nursing staff members self-report		Significant variations in RN's experiences of organizational resources; processes used to support RN supervisory role; limited evidence of RN perceptions of the benefits of training to support role
Castle 2009	3,876 NHs	Primary data OSCAR Nursing Home Compare 2006	Cross-sectional	FTE regular RNs per 100 resident days Any RN agency used in 2006 FTE agency RNs/ 100 beds Agency RN as % of all RNs	11 chronic care quality measures; 3 post-acute quality measures (Process and Outcomes)	Average 12.5% FTE/ 100 beds -RNs 28.3% nursing home had some agency use; 4.1% NHs only used RN agency In NHs with no agency use 13 of 15 QMs QMs significantly lower than in nursing homes with 25% or more agency use positive

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Castle, Engberg, Mendeloff, Burns 2009	7,542 NHs	OSHA data OSCAR ARF	Cross-sectional	FTE RNs/100 residents;	Workplace Injury- Lost Days (Outcome)	Nursing homes with high FTE RNs/100 beds more likely to report high injury rates; lower quality homes more likely to report high injury rates;	positive negative
Decker and Castle(2009)	1,048 cases of DON tenure	2004 National Nursing Home Survey OSCAR ARF	Cross-sectional	DON education level Facility ownership; occupancy rate	Mean tenure of DON (Outcome)	DON education significantly related shorter DON tenure DONs with diploma or associate degree had on average nearly 7 more months of job tenure than DONs with higher degrees; After career experience, DON tenure in not-for-profit nursing homes greater than for-profit chain nursing homes; Increased occupancy associate with increase in DON tenure	negative negative positive

Donoghue and Castle 2009	2,900 NH administrators from 1,333 randomly selected NHs	Primary data Nursing Home Compare OSCAR	Cross-sectional	NH administrator role (leadership style)	RN turnover (Outcome)	Turnover lowest in nursing home with consensus manager, with 7% for RNs;	negative
						Turnover highest in nursing home with shareholder manager (do not solicit input or provide staff information to make decisions) Leadership style and turnover associated	negative
Kim, Harrington, Greene 2009	4,933 annual observations of 1,099 NHs in California 1999-2003	California OSPHD OSCAR MDS ACLAIMS	Longitudinal	RN HPRD	Deficiency citations (Outcomes)	RN HPRD negatively related to total and quality of care deficiencies; marginally related to serious deficiencies	negative
Kim, Kovner, Harrington, Greene, Mezey -2009	201 nursing facilities in CA staffing standards; 210 NHs consistently failed standards of 1,099 free-standing California NHs 1999-2003	California OSPHD ACLAIMS	Longitudinal panel	RN HPRD	Total deficiencies; quality of care deficiencies; Serious deficiencies; (Outcomes)	RN staffing levels negatively related to total deficiencies, quality of care deficiencies, and serious deficiencies Met staffing standards not related to receiving serious deficiencies	negative not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
McGilton -2009	16 RN charge RNs in Ontario Canada	Primary data	Qualitative	RN role		Themes identified- against all odds; getting through the day; stepping in work; leading and supporting unregulated care workers; the intersection of work context and work strategies

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Park and Stearns 2009	55,248 facility-year observations from 15,217 free-standing NHs	OSCAR ARF	Cross-sectional	RN HPRD Impact of 16 states that implemented or expanded staffing standards compared to those without new standards	Quality of Care = % pressure sores; % contrac-tures; %inconti-nence; % catheter use; % restraint use; % Total deficiencies (Process and outcome)	Average RN HPRD = 0.34 No significant association of standards change and resident outcomes; Non-profits had statistically significant increase in RN HPRD; Increased standards associated with small staffing increases for nursing home below or close to new standards; increased standards associated with small reduction in restrain use and number total deficiencies	not significant positive negative

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Colon-Emeric, Plowman, Bailey, Corazzini, Utley-Smith, Ammarell, Toles, Anderson 2010	766 staff members observed; 192 staff interviewed, including 47 RN managers	Primary data	Qualitative	Regulatory framework for NHs by CMS		A shared facility mission strongly impacted staff perceptions of purpose/utility of regulations. In resident-centered culture, regulation increased mindful behaviors. In cost-focused culture, regulations reduced mindful care practices. When managers emphasized punitive aspects of regulation, a decrease in mindful practice observed.
Corazzini, Anderson, Rapp, Mueller, McConnell, Lekan 2010	33 RNs at national DON conference	Primary data	Qualitative	RN role (approach to delegation)		Primary approaches included: follow job description' and consider scope of practice.' Barriers to delegation included: poor partnerships across licensed and unlicensed staff, attitudinal barriers, little RN-level clinical leadership

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Feng, Lee, Kuo, Intrator, Foster, Mor 2010	Not reported (US nursing home annual surveys) of states with wage pass-through during 1996-2004	OSCAR State Medicaid nursing home reimbursement policies 1996-2004	Longitudinal	RN HPRD	Impact of state Medicaid wage pass-through policy on direct care staffing levels (outcome)	No wage pass-through effect for RN HPRD	not significant
Flynn, Liang, Dickson, Aiken 2010	63 Medicare/ Medicaid certified NHs in New Jersey; 1,143 RNs	Primary data Nursing Home Compare	Cross-sectional	RN perception of practice environment Practice Environment Scale of Nursing Work Index (PES)	% residents with pressure ulcers, deficiencies (Outcome)	Supportive practice environment inversely associated with percent of residents with pressure ulcers; No association between staffing levels and Qis	negative not significant
Heath 2010	English staff, family, residents and 25 RNs; 24 care aides; 10 other staff and family	Primary data	Qualitative	RN and others' perceptions of RN role		RN role is broad and multi-faceted; 24 hour presence of RNs is essential	

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Kash, Naufal, Dagher, Johnson 2010	572 DON observations	2003 Texas Nursing Facility Medicaid Cost Report; ARF Primary data	Cross-sectional	DON characteristics and perception of job; NH characteristics	DON intention to leave (12 months and 24 mo) (Outcome)	15% intend to leave have diploma or AA degree; 71% perceived salary as competitive; 16% DONs in for-profit facilities intended to leave within 12 months compared to 7% DONs in not-for-profit. DONs in urban settings more likely to hold college degree and positive indented to leave. Job negative satisfaction significantly associated with intent to leave
Seblega, Zhang, Unruh, Breen, Paek, Wan (2010)	11,611 Medicare/ Medicaid SNFs (1997 compared to 2007)	OSCAR	Descriptive	RN HPRD/ Total HPRD	Change in RN HPRD and skill mix between 1997-2007 (Structure)	Large and medium size facilities had large decrease in RN HPRD (20.3% and 18.6% respectively); decrease in skill mix (23.1% and 19.7% respectively)

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)		Findings
Bowblis 2011	94,371 survey observations from 17,552 NHs (1999-2004)	OSCAR ARF	Cross-sectional	RN as % of total nursing staff; (RN + LPN) as % of total nursing staff Impact of minimum direct care staffing requirements on staffing	% residents restrained, with catheter, feeding tubes, and taking psycho-active medications % residents with pressure ulcers, incontinent, having weight change, rash, facility-acquired pressure ulcers, deficiency citations (Process and Outcomes)	NH with low Medicaid had no change in RN skill mix, but decreased proportion of licensed nurses; NHs with high medicaid increased proportion of RNs; no change in overall skill mix;	not significant positive not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Castle 2011	3,941 NHs reporting consistent assignment practices in 2007	OSCAR primary data	Cross-sectional	FTE RNs/ 100 residents (full,part-time, not agency)	Consistent assignment Deficiency citations Structure and Outcomes	68% nursing homes reported using consistent assignment; actual level varied substantially; Quality of life and care deficiencies significantly lower in facilities with highest levels of consistent assignment; High RN staffing associated with less quality of life citations	negative negative

Note. Consistent assignment = the same caregivers consistently caring for the same residents almost every time they are on duty

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Castle and Anderson 2011	2,839 NHs (2003-2007)	Primary data OSCAR Nursing Home Compare	Longitudinal	FTE RNs per 100 residents (including full, part-time in last quarter); not including DON or agency staff; (RNs/NA + LPNs)	Percent residents with physical restraint use, catheter use, moderate to severe pain; % low-risk residents with pressure ulcers; % of FTE RN turnover in last quarter (total number of RN staff who left employment during past quarter divided by total number RN staff employed during the period; not including DON or agency staff (Process and Outcomes)	Average RN staffing/100 beds = 11.7%; professional staff mix= 0.25%; RN turnover = 14.3% Increasing RN staffing levels associated with better QMs; Increasing professional staff mix associated with increased quality; increased RN turnover will be associated with decreased quality	positive positive negative

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Castle, Wagner, Ferguson-Rome, Men, Handler 2011	99,400 Medicare/ Medicaid certified NH observations (2000-2007)	Primary data OSCAR ARF	Longitudinal	FTE RNs per resident	Deficiency citation for infection control (Outcome)	Lower RN staff levels associated with receipt of deficiency citation for infection control.	negative
Choi (2011)	282 NHs in New Jersey; 863 RNs in 2006	Primary data Nursing Home Compare	Cross-sectional	RN self-report of facility characteristics	Job satisfaction (Outcome)	RN participation in facility affairs, supportive manager, resource adequacy positively associated with RN job satisfaction	positive
Havig, Skogstad, Kjekshus, Romoren 2011	21 NHs with 40 wards; 444 employees (including RNs and 378 residents	Primary data	Mixed methods	FTE RNs full time/ in permanent positions/ total number of workers (including unfilled positions)	Leadership style; quality of care (Structure and Outcome)	Ratios and staff levels RN no related to any quality index; Task and relationship oriented leadership style strongly correlated	not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Munyisia, Yu, Hailey 2011	2,944 observations in high care homes and 2,500 observations in low care homes; 13 RNs over 5 days observed	Primary data OSCAR	Descriptive	% of time in which RN performs an activity	430 RN care activities (Processes)	RN time spent- 48.4% of time communication; 18.1% with medication management, and 17.7% documentation

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Tong 2011	812 certified NHs (1995-2002)	OSHPD	Cross-sectional	RN HPRD	Impact of change in staffing regulation on employment and resident mortality	Low staff nursing homes increased overall nurse hours; no change in RN hours;	not significant
						High staff nursing homes decreased RN HPRD and increased LVN HPRD; changes in RN and LVN hours offset each other	negative
					(Structure and outcome)	Reduced resident mortality suggesting that benefits from increased overall staffing outweigh effects of reduced nurse skill mix	negative

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Townsley, Beck, Dudley, Pepper 2011	161 rural Medicare/ Medicaid NHs; 23 NH staff	Primary data Rural Urban Commuting Areas OSCAR	Mixed methods	RN HPRD	NH RN staffing levels (Structure)	Smaller or government nursing homes had higher RN HPRD than larger, non-government nursing homes. 87% in sample had staffing levels below expert recommendations; Informants reported on challenges related to having sufficient qualified and trained staff	negative
Zhao and Haley 2011	2,305 Florida NHs (2001-2005)	OSCAR Medicare Cost Report	Cross-sectional	RN HPRD	Total deficiency citations (Outcome)	Nursing homes with higher RN staffing ratios less likely to have malpractice paid-losses Total deficiencies on malpractice not significant	negative not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Corazzini, Anderson, Mueller, Thorpe, McConnell 2012	NHs from 2004 nationally representative sample	National Nursing Home Survey 2004	Cross-sectional	FTE RNs/ FTE LPNs and NA RN education level NH facility characteristics	RN jurisdiction (Structural)	homes (41%) had low probabilities of any indicator of RN jurisdiction; mixed capacity NHs with moderate to high probabilities of having higher RN education and staffing levels High capacity positive nursing homes (32%) were more likely to have specialty care programs, relative to low capacity nursing homes; less likely to be chain-owned, larger, have higher technical level of care; lower ratio of LPNs to RNs; administrator with higher education

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Dellefield, Harrington, Kelly(2012)	4,476 observations of RN pressure ulcer prevention practices in 1 NH; 7 RN staff	Primary data	Descriptive	% RN time used for types of care activities	RN care activities for pressure ulcer prevention (Process)	Observed RNs performed indirect care 59% of time on average on day shift. Little observed care could be linked with guideline-based pressure ulcer preventive practices
Harrington Choiniere Goldmann, Jacobsen, Lloyd, McGregor, Stematopoulos, Szebehely 2012	Nursing home RN and direct care nurse staffing standards- 6 countries	Government documents; websites	Descriptive	RN HPRD; nurse staffing ratios	RN staffing levels; Deficiency citations (Structure and outcomes)	Wide variation in both nurse staffing standards and actual staffing levels within and across countries; variation in size and ownership of nursing homes higher deficiencies and 41% higher serious deficiencies than government facilities

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Harrington, Olney, Carrillo, Kang 2012	17,316 NHs (2003-2008)	OSCAR Primary data	Longitudinal	RN HPRD	Deficiency Citations (Outcomes)	Top 10 for profit had lower RN HPRD; Top 10 for profit had 36% higher deficiencies and 41% higher serious deficiencies than government facilities	negative
Hunt, Probst, Haddock, Moran, Baker, Anderson, Corazzini 2012	1,174 Medicare or Medicaid certified or state licensed NHs	National Nursing Home Survey 2004	Cross-sectional	NH facility programs	RN retention as % RNs employed > 1 year (Outcome)	Majority of retention programs not significantly associated with facility-level report of RN retention	not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Mukamel Kang, Collier, Harrington 2012	927 free-standing NHs in California	2006 California OSHPD report	Cross-sectional	RN productive hours	Impact of Medicaid NH reimbursement with incentives for staffing	Increased RN positive staffing levels in 2006 = 2 minutes/ $10 increase in Medicaid rate anticipated 2008
Siegel, Young, Leo, Santillan 2012	29 DONs from 15 states	Primary data	Qualitative	DON role	(Structure)	DONs described a broad and varied understanding of the DON role
Singer, Kitch, Rao, Bonner, Gaudet, Bates, Field, Gurwitz, Keohane, and Campbell 2012	8 randomly selected Massachusetts NHs and 751 employees; including 27 RNs (6% of respondents)	Primary data	Descriptive	RN study participants	Assessment Safety Climate (Outcome)	Assessment of safety climate varied by personnel category; managers perceived more positive climate than direct staff that included RNs, LPNs, and CNAs

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Temkiin-Greener, Cai, Zheng, Zhao, Mukamel 2012	46,044 resident MDSs from 162 New York State Medicare/ Medicaid certified NHs; 7,418 staff, including 964 RNs	Primary data MDS OSCAR Nursing Home Compare	Cross-sectional	RN self-report of work environment and practices	Prevalence of pressure ulcers and urinary/ bowel incontinence (Outcome)	Residents in facilities with worse staff cohesion had significantly greater odds of pressure ulcers and incontinence compared with Residents in facilities with better cohesion scores; Residents in facilities with greater penetration of self-managed teams had lower risk of pressure ulcers, but not incontinence; Consistent assignment not significantly associated with outcomes	negative negative not significant

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Thomas, Hyer, Castle, Branch, andel, Weech-Maldonado 2012	6,000 randomly selected NHs; 375,770 long-stay residents; 4,000 DON and administrator responses; 3,557 MDS assessments	Primary data OSCAR MDS	Cross-sectional	RN HPRD/ (RN + LPN HPRD) RN agency HPRD > 5% of total RN HPRD	Nursing home safety culture; restraint use; residents who fell (Process and Outcomes)	On average, DON and administrator had 63% positive rating of nursing home safety culture (PSC) High ratings of PSC associated with decreased odds of physical restraint use; Residents in nursing homes with lower RN to licensed nurse ratio and RN agency staffing and higher NA staffing less than 5% more likely to be restrained	negative negative

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Trivedi, DeSalvo, Lee, Palumbo Moll Curns Hall, Manish Parashar, Lopman 2012	308 Medicare certified NHs in Oregon, Wisconsin, Pennsylvania reporting at least 1 confirmed or suspected norovirus outbreak to CDC (2009-2010)	CDC data; MDS Nursing Home Compare	Cross-sectional	Daily RN hours/bed	Deaths and hospital-izations (Outcomes)	Facilities with <0.75 daily RN hours/ resident had increased mortality compared with baseline;	negative
						Facilities with >0.75 daily RN hours/resident had no increased mortality;	not significant
						Higher daily RN hours/resident and likelihood of hospitalization were insignificant	not significant
Wagner, McDonald, Castle 2012	120,000 observations from OSCAR (2000-2007)	OSCAR	Longitudinal	FTE RNS/100 beds	Deficiency citation for physical restraints and restrictive side rails (Process)	Restraint/side rail deficiency citations negatively associated with higher staffing levels of RNs and LPNs	negative

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Banaszak-Holl, Castle, Lin, Shrivastwa, Spreitzer 2013	419 NH administrators	Primary data OSCAR AHCA 2007 report of turnover	Cross-sectional	Administrator self-report of NH organizational culture	Turnover as % RNs who leave NH within 6 and 12 month periods (Outcome)	19.3% RNs leaving in 12 month period and RN turnover rates reduced by stronger hierarchical values within nursing home; Market values increased RN turnover; RN turnover not significantly associated with nursing homes having stronger group and developmental cultures	negative positive

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Corazzini, Anderson, Mueller, Thorpe, McConnell 2013	50 state and Washington DC RN & LPN Practice Acts	LexusNexis legal database; Board of Nursing and government websites	Mixed methods	RN and LPN state Nurse Practice Acts	RN vs LPN care practices related to: weight loss; bedfast; urinary tract infections (Process and Outcomes)	14% state NPAs allow focused assessment by LPN; 53% describe LPNs as collecting data; 22% states prohibit LPN supervision or delegation; 82% of states describe RN practice as assessment, care planning, delegation, supervision. 30% NPAs silent about role of LPN in nursing assessment and care planning; 22% of states prohibit LPNs from either supervising or delegating; 8% prohibit both; 82% of states described RN practice as composed of assessment, care planning,	delegation, and supervision; 18% had no language about RN practice 103 practice components; NPAs have differences related to resident pain, catheter use, weight loss, restraints, accounting for skill mix

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Day, Anderson, Mueller, Hunt-McKinney, Porter, Corazzini 2013	2 North Carolina NHs; 5 RNs	Primary data	Qualitative	Nursing Skill Mix		The nursing staff skill mix influences how RNs, LPNs, NA interact in performing care processes; When low RN professional skill mix exists, it is difficult to practice within defined scopes of practice
King, Gilmore-Bykovskyi, Roiland, Polnaszek, Bowers, Kind 2013	27 RNs working in 5 NHs in 3 Wisconsin counties	Primary data	Qualitative	RN description of transitions of residents from hospital to SNF experiences		Hospital discharge information provided to SNF RNs is inadequate and results in care delays

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Konetzka, Park, Ellis, Abbo 2013	2,245 NHs in 6 states with litigation claims	Westlaw's Adverse Filings database OSCAR	Lagged 2-year moving average of litigation threat	RN/ total nursing hours	Pressure Ulcers; law suits (Outcome)	RN nurse to total staffing ratios increased in response to rising malpractice threat. Small magnitude of deterrence	positive
Lerner, 2013	225 Medicare certified NHs in Maryland	Nursing Home Compare	Cross-sectional	RN HPRD	Number and severity of deficiency citations (Outcome)	Average RN HPRD=0.78; Average number deficiency citations = 9.76; RN HPRD accounted for 4% of variance in severity of deficiency citation	negative
McGilton, Tourangeau, Kavcic, Wodchis, 2013	55 RNs from 12 Canadian long-term care facilities	Primary data	Cross-sectional	RN self-report of factors	RN intention to stay (Outcome)	ITS positively associated with lower burnout, higher job satisfaction, older nurses and resident relationships. Leadership support non-significant; work relationships negatively associated with ITS	positive; not significant; negative

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Shin (2013)	25 NHs within 70 miles of Iowa City and size= 50-100 beds and 231 residents	OSCAR MDS 3.0 proposed Quality of Life section	Cross-sectional	RN HPRD	Resident self-reported quality of life (Outcome)	Higher RN HPRD negatively associated with meaningful activity and relationships; Part-time RN HPRD positively associated with comfort and enjoyment	negative positive
Shin, Park, Huh (2013)	8 NHs in New York State; 142 residents	Primary data OSCAR MDS	Cross-sectional	RN HPRD RNs/ LPNs + NA	Resident self-reported quality of life; RN turnover measured using Nursing Personnel Data Collection Tool and Crude Turnover Rate (Outcomes)	Higher ratio of RNs negatively associated with meaningful activity, food enjoyment, and security domains; RN turnover negatively associated with dignity and meaningful activity, and security domains	negative

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Spector, Limcangco, Williams, Rhodes, Hurd (2013)	62,745 NH residents who became long-stay residents (2006-2008)	MDS OSCAR Brown University state policy data	Cohort study	RN hours/ resident	Type of hospitaliz- ation with 3 categories ACSC; Ambulatory- care & NH unavoidable conditions (NHUCs)	For additional nursing home avoidable condition hospitalizations, (ANHACs) residents in for-profit facilities had higher risk; residents in facilities with higher RN hours had lower risks. Risks higher in NHs with more deficiencies	negative positive
Troyer and Sause 2013	7,896 complaints to North Carolina Long-Term Care Ombudsman Program (2002-2006)	OSCAR MDS Ombudsman complaint data	Cross- sectional	RN HPRD	Average number of complaints; Total deficiencies (Outcomes)	Average RN HPRD = 0.54 The higher the number of RNs, the greater the number of complaints Health deficiencies associated with number of complaints	positive positive
Zhang, Unruh, Wan (2013)	All NHs in OSCAR dataset (1997-2001)	OSCAR	Descriptive,	RN HPRD RN/all nurses	Nursing skill mix (Structural)	Overall downward trend in RN HPRD and increase i in non-RN HPRD; RNs substituted for non-RNs.	

Table 10

Summary of Reviewed Studies

Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings	
Castle, Wagner, Fergson, Handler 2014	148,900 NH observations (2000-2009)	OSCAR ARF Medicaid reimbursement levels	Longitudinal panel study	RN HPRD	Deficiency Citation (Outcome)	Low RN HPRD associated with receiving hand hygiene deficiency citation	negative
Chen and Grabowski 2014	5,486 California and Ohion NHs surveyed (1996-2006) and 45,738 NH year survey observations	OSCAR	Longitudinal	RN HPRD Impact of minimum staffing regulation in California and Ohio on skill mix	% residents with restraints, receiving psychoactive medications, catheterized and citation scope; % residents with contractures and pressure ulcers (Process and Outcomes)	Fewer RNs hired relative to NAs; Reduced absolute level of indirect care support staff (housekeeping, food service, activities) Reduced number of severe deficiencies and contractures; Other measures remained unchanged	negative positive not significant

Table 10

Summary of Reviewed Studies

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Hunt, Corazzini, Anderson 2014	1 Medicare Medicaid certified NHs in Central North Carolina with 400% turnover in 9 months; 12 RNs	Primary data	Qualitative	DON self-report		Themes for DON, nurse manager turnover: lack of shared vision;weakened communication networks to promote oversight; impaired ability of nurse managers with weakened QI mechanisms; Turnover at all staff levels nonlinear, socially mediated, contributed to dramatic care deficits

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Table 10

Summary of Reviewed Studies

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)		Findings	
Lee, Blegen, Harrington 2014	195 Medicare certified NHs in Colorado	OSCAR MDS ARF State Medicaid reimbursement data	Cross-sectional	RN HPRD	% resident using anti-psych drugs, indwelling catheter, low risk pressure ulcers, urinary tract infections, weight loss (Process and Outcomes)		Higher RN HPRD associated with 11% lower prevalence of pressure ulcers; no significant association with other quality indicators	negative not significant

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Table 10

Summary of Reviewed Studies

Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Lin (2014)	3,275 Medicare/ Medicaid certified NHs (1999 and 2003)	OSCAR ARF	Longitudinal	RN HPRD (RNs + DONs)	Number of deficiency citations; % residents with pressure ulcers and contractures (Process and Outcomes)	Using instrumental variable estimation increasing RN HPRD by 0.3 HPRD would increase quality by >16% (e.g. lower number of deficiency citations; Strong relationship between RN HPRD and quality of care outcomes; No significant RN HPRD using ordinary least squares model

Table 10

Summary of Reviewed Studies

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Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Rahman, Grabowski, Gozalo, Thomas, Mor (2014)	692,875 dually eligible Medicare beneficiaries aged 65 and over discharged from a hospital to a SNF without prior NH use (July 2004- June 2005)	MDS Medicare Claims and Enrollment records; Medicaid Analytical Extract data; OSCAR inpatient and SNF Medicare Standard Analytic File	Cross-sectional	Total FTE RNS; FTE RNs/ total nurses	Discharge (Outcome)	Dual eligible more likely to be discharged to free-standing and for-profit facilities; Share of RNs among total facility nurses 3% lower for dual eligible relative to Medicare-only patients negative

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Table 10

Summary of Reviewed Studies

Author(s)	Sample and Sample Size	Data Source	Study Design	Structural Quality Indicator	Quality Indicators (Types)	Findings
Shippee, Hong, Henning-Smith, Kane (2014)	369 Medicare certified NHs in Minnesota (2007-2010)	Primary data Minnesota Department of Human Services and Minnesota Department of Health data MDS	Longitudinal	RN HPRD	Resident-Self-reported quality of life (QOL) (Outcome)	Higher RN HPRD and more activity staff and higher quality improvement scores were positively associated with multiple QOL domains positive

Note. ACLAIMS = Automated Certification and Licensing Administrative Information and Management Systems; ADON = assistant director of nursing; ARF = Area Resource File; CDC= Centers for Disease Control; CMS = Centers for Medicare and Medicaid Services; DON = director of nursing; FTE = Full-time Equivalent;LPN = license licensed practical nurse; LVN = licensed vocational nurse; MDS = Minimum Data Set; NHs = nursing homes; OSHA = Occupational Safety and Health Administration; OSHPD= California Office of Statewide Health Planning and Development; OSCAR = On-line Survey and Certification Automated Record; QA = quality assurance; QMs = quality measures; SNFs = Skilled Nursing Facilities; US = United States