

Continuing Education Research Studies

The tables below describe 113 research studies of continuing education linked to patient outcomes, changes in behavior or practice, and changes in knowledge. Outcome measures such as safety climate are included as potential precursors to changes in behavior or practice.

Note that for the purposes of this report, outcome summaries are given only for nurses from the studies that included CE participants from other disciplines unless the article did not report results separately for different types of CE participants.

Table 1. Changes in Patient Outcomes

<i>Study:</i>	<i>Continuing Education:</i>	<i>Outcome(s):</i>
Ammentorp et al. (2010) – 32 healthcare professionals, including 25 nurses, 895 parents pre-course, and 1937 parents post-course, from a department of paediatrics in a regional hospital in Denmark	a 3-day training course on communication skills for eliciting and responding to patient concerns and needs	significantly increased proportion of parents post-course satisfied with 4 of 13 questions on care and continuity no significant change in proportion of parents satisfied with 9 questions on information
Avorn et al (1992) – 12 nursing homes in Massachusetts matched in 6 experimental-control pairs in regard to ownership, size, level of drug use, etc.	geriatric pharmacology program to decrease use of psychoactive drugs	better scores in <ul style="list-style-type: none"> • psychoactive drug use; • discontinuation of anti-psychotic drugs; • deterioration of cognitive function; • anxiety reports
Brown et al (1999) – >20 Nurse Practitioners in Kaiser Permanente HMO in Oregon (also 60+ MDs and other clinicians)	4-hour group workshops on skills: <ul style="list-style-type: none"> • building effective relationships with patients • successful negotiation 	no difference in patient ratings about clinicians' communication skills
Gill & Ursic (1994) – hospital in Vancouver, BC; elderly hip fracture patients, 90 experimental, 63 control	experiential exercises and group discussions to develop care and management protocols (e.g., nutrition, voiding, confusion)	better rates of <ul style="list-style-type: none"> • time to first ambulation • length of stay on orthopedic unit
Lange et al. (2009) – 47 RNs in 2 hospitals in the Northeast	a 30-hour, 10-module online educational program on geriatric care	declining trend in average number of total unit falls at 3-month follow up but not statistically significant
Monahan (1993)	several 2-hour dementia-related sessions	17 of 36 behavioral symptoms

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Study:	Continuing Education:	Outcome(s):
– 22 nurses & 45 dementia patients in special unit of nursing home	on, e.g., cultural and medical perspectives, interpersonal relations, Activities of Daily Living, adaptive activities	decreased post-test with the most dramatic reductions occurring in: <ul style="list-style-type: none"> • not following directions • poor personal hygiene • poor table manners • physically assaultive behavior • angry outburst • poor judgment
Pridham et al (2006) – public health nurses: 11 experimental, 116 control; patients: 12 mothers of Very Low Birth Weight (VLBW) babies, 4 controls	28 classroom hours on supporting families to develop caregiving competencies through guided participation	no difference in mothers self-assessment of caregiving competency most experimental mothers rated selves as satisfied with guided participation
Stein et al. (2001) – 20 Tennessee nursing homes (10 intervention with 76 patients, 10 control, with 71 patients)	program on optimal treatment of musculoskeletal pain	improvements in <ul style="list-style-type: none"> • nonsteroidal anti-inflammatory drugs (NSAIDS) use (decreased) • acetaminophen use (increased) no difference in pain or function
Zurmehly (2013) – 44 nurses and 180 patients in a hospital in the Midwest	30-minute online self-study module and study materials in an educational toolkit for a nursing intervention of oral care for mechanically ventilated ICU patients	post-intervention reduction in rates of ventilator-associated pneumonia

Table 2. Changes in Behavior or Practice

Study:	Continuing Education:	Outcome(s):
Alemagno et al. (2010) – 256 health care workers (90% RN, 5% LPN) in 2 hospitals in Ohio	online program of 3 1-hour sessions on worker hand hygiene, including instructional video, self-assessment, and self-improvement plan	better posttest scores on self-assessed compliance with hand hygiene behaviors
Allison (1995) – 24 nurses from a variety of backgrounds at a large teaching hospital, retrospective 16	3-day wound management course	98% of retrospective reports indicated actively making changes in wound management practices in their wards

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Study:	Continuing Education:	Outcome(s):
Barta & Stacy (2005) –15 nurses at a hospital in Nebraska	brief smoking cessation training program based on AHRQ Clinical Practice Guidelines	significantly increased follow up scores on 6 of 7 behaviors for facilitating bedside smoking cessation interventions (advise to quit, assess readiness, assist to set quit date, provide literature, recommend medication, encourage social support)
Beno et al. (2005) – 18 RNs, 33 LPNs and 25 other clinicians in a managed care pediatric department	two 60-minute seminars on improving management of pediatric overweight	clinician reports of increased use of recommended screening tools and changes in office practices to implement them
Boutin et al. (2006) – 27 telephone triage nurses in Quebec, Canada	3-hour training in case studies & group discussion of e.g., computerized nursing protocol on asthma, including evaluation of severity	improvements in: <ul style="list-style-type: none"> • clinical evaluation of health problems • advice provided by nurses (including evaluation of caller's comprehension of information) no difference in referral to Asthma Education Center
Bradley et al. (1995) – 61 nursing home staff ("some RNs") in 4 Nova Scotia long term care facilities	10-part restraint education program	restraint use declined in 3 of 4 facilities Increase in knowledge of elderly care in general
Campbell et al. (1991) – licensed and unlicensed nursing staff in 4 nursing homes, 96 experimental, 70 control; patients: 51 experimental, 37 control	4-hour program on urinary incontinence, including definition, prevalence, normal elimination, age-related changes, techniques for new protocol, etc.	experimental group did not fully implement the steps of the protocol
Carpico & Jenkins (2011) – 38 nurses in a hospital in Pennsylvania	simulation training on resuscitation for cardiac arrest	higher postintervention performance scores indicating adherence to American Heart Association resuscitation standards
Cohen-Mansfield et al. (1997) – 103 nursing staff recruited from 21 units in 4 Washington, DC-area nursing homes	40 minute program on dementia	reports that residents were allowed to roam/wander to a greater extent at follow up compared to pretest improvements in nurse ratings of <ul style="list-style-type: none"> • work difficulty

Table 2. Changes in Behavior or Practice

Study:	Continuing Education:	Outcome(s):
Coleman et al. (2004) – 62 healthcare providers (MDs, RNs, Nursing Assistants) in 2 Army Reserve hospitals in Arkansas & Texas, 32 experimental, 30 control	use of standardized patients in clinical scenarios to assess performance on clinical breast examinations & breast screening	<ul style="list-style-type: none"> • quality of care greater improvements in: <ul style="list-style-type: none"> • quality of clinical breast examinations • breast cancer screening
Cronin-Stubbs et al. (1994) – 220 RNs, LPNs, and Certified Nurse Aides in 6 Illinois nursing homes and 4 home health agencies in a stratified random sample	one-day program on geriatric rehabilitation	increases in nurses' documented behaviors related to motivations, assessment, and independence of patients
Curran et al. (2007) – 1,628 nurses and 2,097 people in health and other professions (868 at 3 month follow up) in the Atlantic provinces of Canada	6 modules ranging from 1 to 2 days to foster better interprofessional collaboration in primary health care	better follow up self reports of performance change in building community relationships, conflict resolution, facilitating adult learning, team building, and understanding primary health care
Czurylo et al. (1999) – 185 participants from 476-bed community medical center in suburb of major Midwestern city, posttest 50, follow up 68	pain management lecture	98% of follow up reports indicated improved patient care from use improved posttest scores on use of information for care
Dennison (2007) – 20 nurses on a 12-bed coronary care unit	2 computer-based modules on medication error reduction and high-alert medications in critical care	no posttest change in <ul style="list-style-type: none"> • use of behaviors advocated to improve medication infusion safety • number of infusion pump alerts • number of reported errors
Einspruch et al. (2011) – 24 instructor candidates from hospital nursing departments, medical schools, and other organizations in Oregon (13 classroom, 11 internet)	1 day of instructor-led or self-guided training on instructional methods for basic life support	no post-training improvement in instructional performance as evaluated by expert raters
Evans et al. (1997) – 3 Philadelphia-area nursing homes with 643 total residents & identical restraint use policies	comprehensive 6-month restraint education program taught by gerontologic nurse specialist	reduction in restraint prevalence for 3 measured time periods

Table 2. Changes in Behavior or Practice

Study:	Continuing Education:	Outcome(s):
Hagen & Sayres (1995) – 134 RNs and Nursing Assistants in a British Columbia 200-bed extended-care hospital	three 30-minute modules over 3 months on dementia with particular focus on aggression	large drop in reported incidents of physical aggression toward staff
Hagler et al. (2012) – 160 staff nurse preceptors in 7 hospitals in Arizona	half-day participatory interactive workshop on supporting nursing students in evidence-based practice	52% of participants self-reported an increased use of evidence-based practice at 1- to 25-month follow up
Hinchman et al. (2005) – 66 nursing staff and 37 other clinicians in a pediatric department in Georgia	2 60-min seminars trainings for healthcare teams on management of pediatric overweight	increased post training use of some recommended tools and practices as measured by chart abstraction increased use sustained at 6- month follow up
Giarelli et al. (2012) – 37 nurses in a city in Pennsylvania	2-day workshop on the clinical management of autism spectrum disorder	at 4- to 6-month follow up, 74% or more of participants reported incorporating learning into practice
Harrington & Walker (2002_) – 91 staff, including RNs and LPNs (43 experimental, 23 control) at a life care community facility	computer-based or instructor-led modules on fire safety in nursing facilities	no significant differences for experimental groups in fire safety practices
Harris et al. (1995) – 295 RNs, 114 LPNs in 24 Oklahoma hospitals (also included 45 physicians & 11 other health care providers); patients: 238 mother-infant pairs with sick or at risk neonates	completion of a self-paced (up to 4 months) perinatal continuing education program	greater rate of some health care practices at Time 2 (e.g., use of methods for gestational assessment)
Huseman (2012) --112 RNs and 193 nurse aides in a hospital in Pennsylvania	random, unannounced simulated code blue drills over a 3-month training period using a high-fidelity patient simulator	post training improvements in response times for start of chest compressions, administration of epinephrine no improvement in administration of defibrillation improved response was not consistently maintained at 3 months

Table 2. Changes in Behavior or Practice

Study:	Continuing Education:	Outcome(s):
Jerome-D'Emilia et al. (2010) – 17 nurses and LPNs in 8 community health centers (4 experimental, 4 control) in Virginia	4 sessions by distance learning methods about timely and appropriate mammography screening	only 1 intervention group center showed a post-intervention increase in referrals and mammography screenings (1 control centers also showed an increase)
King et al. (2007) --98 RNs at a disease-management company call center in the Southeast	4 90-minute sessions over a year on effective patient teaching and problem-solving	post-training improvements in teaching scores evaluated by trained coder audits of interactions with clients
King et al. (2002) – 30 nurses and dietitians, 2 physicians, and 1 pharmacist at a university diabetes training center in Tennessee	24-hour training over 3 days on effective patient teaching and problem solving	improved post-training skills as measured by rater evaluations of standardized patient teaching exercise
Mawn & Pakkala (2000) – 24 nurses at an immunization update conference in Massachusetts	half-day conference including <ul style="list-style-type: none"> • pediatric immunization update • discussions of cultural considerations 	no difference in behavior change reports 6 months later
Meador et al. (1997) – 1311 elderly residents in 12 Tennessee nursing homes, 680 experiment, 631 control	program training to use structured guidelines rather than antipsychotic drugs for management of behavioral symptoms	<ul style="list-style-type: none"> • decreased use of antipsychotics • 33% of antipsychotic users withdrawn by month 6 with no increase in behavioral symptoms • 25% of those with continued use had a dose reduction of 50% or greater
Middleton et al. (1999) – 83 people in long-term care settings, including RNs, LPNs	8-hour seminar on restraints	31% of participants reported their facility implemented changes, e.g., reviewing recreational programs
Muller-Staub et al. (2008) – 444 nursing diagnoses from 6 units (3 experimental, 3 control) in a hospital in Switzerland	22.5 hours over 5 months of interactive, guided clinical reasoning discussing real patient cases to facilitate critical thinking and reflection	<p>better scores for the intervention group on quality of nursing documentation:</p> <ul style="list-style-type: none"> • nursing diagnoses (how well the diagnostic problem is stated) • nursing interventions (if/how specific and effective) • nursing outcomes (clarity of descriptions of changes in patients)
O'Connell et al. (1992) – 51 healthcare practitioners (RNs & LPNs) at 5 nursing	education program on correct metered-dose inhaler technique	improvement 2 months later in verbalization and demonstration of correct metered-dose inhaler

Table 2. Changes in Behavior or Practice

Study:	Continuing Education:	Outcome(s):
homes		technique
Osborn et al. (2010) – 45 nurses and 26 other healthcare providers (37 at follow up) in Connecticut	2-hour session on screening, assessing, treating, and/or referring patients with diabetes for depression treatment	self-reported increases at 6-week follow up of educating diabetes patients about depression no other changes at 6 week follow in depression management practices
Parker et al. (1995) – RNs and LPNs in 3 North Carolina long-term care facilities, 35 treatment and 10 control	seven 20-minute sessions on diabetes control over 12 weeks	no difference in charted behaviors (e.g., giving insulin)
Peden (1990) – 20 RNs and their supervisors	1-day seminar on patient education	RN and supervisor reports of increased patient education
Price et al. (2005) – 33 Nurse Practitioners & Physician Assistants in Kaiser Permanente of Colorado system (also included 74 MDs); 2744 patients	breast mass education through 8- or 2-hour symposium of lectures, case discussion, demonstrations, and workshops plus 4-hour 1-on-1 mentorship with surgeon	more training and individual training was associated with <ul style="list-style-type: none"> • performing more breast mass aspirations • attempting more aspirations
Ray et al. (1993) – 4 rural Tennessee nursing homes; patients: 194 experimental, 184 control	six 1-hr inservices to train staff to improve management of behavior problems & minimize use of antipsychotic drugs	decreases in <ul style="list-style-type: none"> • days of antipsychotic use • days of physical restraint use
Santmyer et al. (1992) – RNs and LPNs on 3 units in a 233-bed LTC teaching facility; residents: 90 experimental, 69 control	2-week program on <ul style="list-style-type: none"> • psychiatric behavior problems and psychotropic medications • use of standardized nursing care plans & behavior observation flow sheets 	increases in quantity of nursing documentation in medical records
Slater et al. (2012) – 55 healthcare professionals (28 doctors, 13 nurses, 9 administrators, 3 pharmacists, 1 occupational therapist, and 1 social worker) in 11 multiprofessional teams from a hospital, mental health service provider, or individual general practices in northern England	20-week team-based training program including an online module, workshops, and team and facilitator support, to encourage action learning for addressing patient safety issues	improvements in patient safety by 8 of 11 teams as demonstrated through the use of weekly data plotted on run charts improved post-training scores (n=24) on communication openness dimension of patient safety culture; no change on seven other safety culture dimensions
Strumpf et al. (1992)	restraint education program taught over a	decline in restraint prevalence 3

Table 2. Changes in Behavior or Practice

Study:	Continuing Education:	Outcome(s):
– 38 staff (RN, LPN, nursing assistants) in one unit of 120-bed nursing home	4-month period	months after the program
Smith et al. (2003) – all nursing staff and 397 patients in a hospital in Georgia	formal classroom inservice offerings with self-study modules for reinforcement on nursing assessment strategies and restraint optional interventions for managing patients exhibiting disruptive behaviors	decreases at 3-month follow up (with hospital census steady) in <ul style="list-style-type: none"> • overall use of physical restraints • length of time patients were restrained
Stecker & Stecker (2012) – 25 nurses in a hospital in the Northeast	4 45-minute sessions using presentation, discussion, and case based scenarios on nursing assessment of patients admitted to epilepsy monitoring units	better posttest scores measured by rater evaluations of videotaped assessment and patient interaction in 2 of 7 areas: <ul style="list-style-type: none"> • neurological exam • respect
Sundel et al. (1994) – 265-bed private nursing home in Dallas, Texas, 182 employees Time1, 209 employees Time2; 170 residents Time1, 70 residents Time2	90 minute training session on adverse effects and reform laws related to restraint use	reduction in number of residents on restraints
Timmel et al. (2010) – 28 staff of 18-bed surgical unit in Johns Hopkins	comprehensive unit-based program on safety	improvements in <ul style="list-style-type: none"> • teamwork climate • safety climate • perceptions of working conditions and management
Tucker et al. (2008) – 27 nurses in a medical center in the Midwest	3-day standardized parent-teacher training program on child behavior management skills adapted for inpatient child and adolescent psychiatric nurses, including study of manual and video vignettes, role-playing, and dialogue with trainer	post-workshop changes in observed behavior management skills (measured by videotaped RN-child interactions): <ul style="list-style-type: none"> • increased positive statements • decreased negative statements • increased use of commands <p>increases in post-workshop self-reports of frequency:</p> <ul style="list-style-type: none"> • working with parents • use of praise and incentives <p>no increases in post-workshop self-reports of frequency of use of 4 other strategies</p>

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Study:	Continuing Education:	Outcome(s):
Valente & Murray (2011) – 30 nurses in a hospital in California	in-class and on-line presentations on medical safety, medication allergies, and adverse drug events, accompanied by distribution of educational information to patients	increased percentage of overall adverse drug events reported by nurses in the 8 months following education
Weitzel et al. (2011) – staff from 5 units and 166 observations of staff-patient interactions (86 pre- and 80 post-intervention) in a medical center in Illinois	12-minute video scenario, distributed via staff meetings and nursing unit council meetings, on the use of inappropriate and appropriate communication techniques with hospitalized elderly patients with dementia	improvements at 6-month follow up in observed frequency of use for 5 of 8 appropriate communication techniques
Zurmehly (2013) – 44 nurses and 180 patients in a hospital in the Midwest	30-minute online self-study module and study materials in an educational toolkit for a nursing intervention of oral care for mechanically ventilated ICU patients	post-intervention increase in frequency of oral care measured by examination of patient electronic medical records

Table 3. Changes in Knowledge

Study:	Continuing Education:	Outcome(s):
Alemagno et al. (2010) – 256 health care workers (90% RN, 5% LPN) in 2 hospitals in Ohio	online program of 3 1-hour sessions on worker hand hygiene, including instructional video, self-assessment, and self-improvement plan	better posttest scores on a 14-item knowledge test based on CDC's <i>Guideline for Hand Hygiene in Health-Care Settings</i>
Al-Hussami et al. (2011) – 68 RNs working as clinical instructors in hospitals in Amman, Jordan, 30 experimental and 38 control	4-hour Preceptor Training Program	better scores for experimental group and better improved posttest scores on knowledge of clinical teaching
Anson et al. (2010) – 426 nurses in a Midwestern Magnet pediatric hospital	38-minute web-based tutorial on evidence-based practice guidelines for venipuncture practices in children	posttest improvements in: <ul style="list-style-type: none"> • ability to grade IV infiltrates and phlebitis • understanding of the need to limit venipuncture to 2 attempts
Bell et al. (2007) – 59 RNs with psychiatric patients near large Midwestern academic medical center	1-day conference on genomics	improved posttest scores on genomic knowledge
Bell et al. (2012)	a 2-day pediatric resource nurse program	improved postprogram mean scores

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Study:	Continuing Education:	Outcome(s):
– 14 nonpediatric RNs at a children’s hospital in North Carolina	in pediatric assessment and care followed by a half day of required case studies and projects presentation	on an instrument designed to measure pediatric knowledge, skills, or comfort for nonpediatric nurses who may provide care to children
Berarducci et al. (2002) – 63 RNs, women’s health symposium in Florida	lecture and question-answer period based on National Osteoporosis Foundation guidelines	better posttest scores on osteoporosis-related knowledge
Blum et al. (2012) – 222 nurses at a hospital in Florida	self-directed computer-program on assessment of veno-thrombolytic event risk and appropriate prophylaxis	better posttest knowledge scores
Bradley et al. (1995) – nursing home staff in 4 Nova Scotia long term care facilities, 61 staff ("some" RNs)	10-part restraint education program	increase in knowledge of elderly care in general
Campbell et al. (1991) – licensed and unlicensed nursing staff in 4 nursing homes, 96 experimental, 70 control; patients: 51 experimental, 37 control	4-hour program on urinary incontinence, including definition, prevalence, normal elimination, age-related changes, techniques for new protocol, etc.	increased knowledge scores
Chang et al. (2013) – 49 clinical nurses in a large medical center in Taiwan	1 day education program on critical appraisal of evidence	improved post intervention scores on basic knowledge of critical appraisal
Cheng et al. (2007) – 38 nurses and 31 physicians at a pediatric medical center in Taiwan	80-minute multimedia, discussion, and reading program on care for children with asthma	improved posttest scores on asthma care knowledge
Cibulka (2011) – 5 RNs in a Magnet academic medical center	self-directed, 12-module web-based course on research ethics	successful overall pass rate on learning and knowledge retention assessed by tests following each module
Considine et al. (2006) – 20 nurses in 2 emergency departments in Australia	self-directed learning package on supplemental oxygen administration	improved posttest decisions based on hypothetical scenarios on: <ul style="list-style-type: none"> • mask choice • oxygen delivery no posttest improvement in parameters used to assess oxygenation

Table 3. Changes in Knowledge

Study:	Continuing Education:	Outcome(s):
Cox et al. (2011) – 60 nurses in a Magnet hospital in the Northeast, 20 each in 2 experimental groups, 20 control	6 1-hour classroom programs or a computer-based, self-learning module on pressure ulcer etiology, risk factors, identification, and prevention	better posttest scores on a 50-item pressure ulcer knowledge test knowledge gains declined at 3 months with no further decline at 6 months
Cruz et al. (2009) – 39 nurses in Brazil	16-hr course on critical thinking and clinical reasoning	better posttest diagnostic accuracy on 2 nursing case studies
Dancy et al. (2000) – 240 psychiatric and non-psychiatric nurses in Illinois	5-hour program on the fundamentals of mental health and HIV/AIDS	better posttest scores on a 20-item training knowledge questionnaire
Davila (2006) – 20 nursing staff members of a public health department	power point lecture, training video, and panel presentation on intimate partner violence	no posttest difference in knowledge scores
Dennison (2007) – 20 nurses on a 12-bed coronary care unit	2 computer-based modules on medication error reduction and high-alert medications in critical care	better posttest scores on medication safety knowledge
Donahue et al. (2011) – 76 nurses in a hospital in the Northeast	21-hour geriatric nursing program based on the Hartford Institute for Geriatric Nursing Try This series	better posttest scores on knowledge regarding care of older adults
Durkin (2008) – 31 RNs in a children's hospital in Massachusetts, 2 experimental groups	2 presentations on cranial nerve function and assessment, interactive or text-only	better posttest scores on knowledge test; only the interactive group retained knowledge gains at follow up
Eaton-Spiva & Day (2011) – 407 bedside nurses (84 post-test) in a hospital in the Southeast	computer-based slide presentation on diabetes pathophysiology, progression, effects, and treatment	no posttest differences in knowledge scores
Ekundayo et al. (2013) – 217 healthcare providers (nurses, pediatricians, and other professionals) in 5 major cities in the United States	a 'lunch and learn' educational program on child passenger safety	better posttest responses to knowledge questions with higher proportion of respondents answering correctly
Garrard et al. (2006) – 54 nurses and other clinicians at 28 Virginia hospitals	8-month training program in management and treatment regimens for the hepatitis C virus	better posttest scores on knowledge
Gesin et al. (2012) – 20 surgical-trauma ICU	introduction of a delirium screening tool and multifaceted education including	increased agreement between participating nurses and

Table 3. Changes in Knowledge

Study:	Continuing Education:	Outcome(s):
nurses in a hospital in North Carolina	pharmacist-led didactic lecture, web-based module, and nurse-led bedside training	independent judges on assessment of delirium among patients
Graham et al. (1997) – 52 experimental nurses & 15 control nurses, University Hospitals of Cleveland	6 class hours on chemical dependency	better scores on <ul style="list-style-type: none"> • substance abuse knowledge assessment • self-rated competency
Guardini et al. (2008) –168 nurses (98 at 18-month follow-up) in Italy	seven 7-hour sessions on postoperative pain management	better posttest scores on knowledge questions marked decrease on some knowledge questions at 8 months
Gutekunst et al. (2012) – 63 RNs in a health system in Pennsylvania	48-hour advanced course across 6 weeks on medical-surgical nursing	better posttest knowledge assessment scores
Hagemaster et al. (1993) – 58 nurses in key clinical settings	2.5-day workshop on alcohol and drug abuse over 2 weeks	better posttest scores on substance abuse knowledge
Harrington & Walker (2002) – 91 staff, including RNs and LPNs (43 experimental, 23 control) at a life care community facility	computer-based or instructor-led modules on fire safety in nursing facilities	better posttest scores for experimental groups on fire safety knowledge
Harris et al. (1995) – 295 RNs, 114 LPNs in Oklahoma 24 hospitals (also included 45 physicians & 11 other health care providers); patients: 238 mother-infant pairs with sick or at risk neonates	completion of a self-paced (up to 4 months) perinatal continuing education program	improved posttest scores on a 100-item knowledge test
Huber (1992) – RNs, LPNs, and nursing assistants from a 147-bed skilled nursing facility in Covington, Kentucky (also included administrative, support, and ancillary staff)	three 1-hour classes on the myths of aging and normal age-related changes	better posttest scores on knowledge for LPNs and nursing assistants no difference on posttest knowledge for RNS
Jerome-D'Emilia et al. (2010) – 17 nurses and LPNs in 8	4 sessions by distance learning methods about timely and appropriate	better knowledge scores for the intervention group

Table 3. Changes in Knowledge

Study:	Continuing Education:	Outcome(s):
community health centers (4 experimental, 4 control) in Virginia	mammography screening	
Larsen & Zehner (2011) – 31 public health nurses in Wisconsin	web-delivered education on preceptor role self-efficacy and knowledge	better posttest scores on preceptor knowledge no significant difference from initial knowledge at 3-month follow up
Liaw (2003) – 25 nurses (13 experimental, 12 control) in 2 hospitals in Taiwan	videotaped and personalized instruction to enhance NICU nurses' abilities to assess preterm infant behaviors and offer supportive interventions	better scores at posttest compared to control group on cognitive abilities as measured by a video test of preterm infant behavioral cues
Lyons & Kasker (2012) --20 nurses from a Magnet hospital in Pennsylvania	1-day program on intravenous catheter insertion	better posttest and 8-week follow up scores on knowledge posttest improvement on 8 of 14 skills test items
Maneval et al. (2012) --26 new graduate nurses (13 experimental, 13 control) at a large urban hospital	6 patient simulator scenarios designed to promote critical thinking and clinical decision making	no difference in posttest scores on measures of critical thinking or clinical judgment
Markert et al. (2003) – 667 physicians, nurses, and other healthcare professionals participating in 8 programs, samples ranged from 39-179	9 continuing medical education programs (gastroenterology, trauma, perinatology, pain management, fertility care 1, fertility care 2, pediatrics, colorectal diseases, Alzheimer's disease)	significant gains in knowledge for 6 of the programs
Mawn & Pakkala (2000) – 24 nurses at an immunization update conference in Massachusetts	half-day conference including <ul style="list-style-type: none"> • pediatric immunization update • discussions of cultural considerations 	better 6-month follow up posttest scores on a knowledge of current standards of practice in childhood immunizations
Mollon et al. (2012) – 488 nurses and 121 other health professionals (232 nurses of 282 total at posttest) in a hospital in California	online learning module on evidence-based practice	no posttest changes in knowledge/skills
Moore & Allan (2012) – 140 community health nurses in Canada	a 30-minute education session on administration of intramuscular immunizations	greater posttest percentage of respondents understanding best practice recommendation related to aspiration and injection technique

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Study:	Continuing Education:	Outcome(s):
Neafsey (1997) – 27 RNs enrolled in a pharmacy course	home-study computer program on pharmacokinetics	better posttest scores on: <ul style="list-style-type: none"> • knowledge • self-efficacy
Neafsey (1998) – 18 advanced practice nurses in a primary care NP clinical seminar course	computer-assisted instruction program on the pharmacy of alcohol	better scores 5 months' post-program on: <ul style="list-style-type: none"> • knowledge • self-efficacy
Nellis & George (2012) – 45 advanced practice nurses enrolled in a doctor of nursing practice program	a short online self-study module on medical malpractice	larger posttest proportion of participants responding correctly to knowledge questions
Nyamathi et al. (2010) – 211 nurses (112 experimental, 99 control) in California	computerized education and problem solving program with 6 scenarios on category A bioterrorism attack agents or a standard web-based didactic program	better post-education performance for both groups on <ul style="list-style-type: none"> • solving case studies involving identification of specific biological agents • number of problems solved
Palmer et al. (2008) – 66 RNs & 39 LPNs at University of North Carolina Nursing School	1-day geriatric nursing workshop	better posttest scores on geriatric knowledge
Parker et al. (1995) – RNs and LPNs in 3 North Carolina LTC facilities, 35 treatment and 10 control	seven 20-minute sessions on diabetes control over 12 weeks	better scores on 36-item knowledge test
Rosswurm et al. (2003) – 23 nurses and 44 nurse aides providing direct home care to functionally dependent elders in southern West Virginia	12-hour psychoeducational program on improving geriatric care	better Time 2 scores on: <ul style="list-style-type: none"> • competence • knowledge • resourcefulness (aides only) <p>no difference in scores on resourcefulness for nurses</p>
Salinas & Abdolrasulnia (2011) – 186 nurses (93 control) in various practice settings	10 regional meetings and 1 satellite symposium on optimal analgesics and drug safety for pain management	greater likelihood of experimental group to make evidence-based care choices as measured by responses to case vignettes
Santmyer et al. (1992) – RNs and LPNs on 3 units in a 233-bed LTC teaching facility; residents: 90 experimental, 69 control	2-week program on <ul style="list-style-type: none"> • psychiatric behavior problems and psychotropic medications • use of standardized nursing care plans 	improved posttest scores on 14-item knowledge test

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Study:	Continuing Education:	Outcome(s):
control	& behavior observation flow sheets	
Schubert (2012) –12 medical-surgical nurses in a university medical center in the Midwest	participation in a simulated failure to rescue event where the patient's clinical condition deteriorated rapidly	better posttest scores on knowledge of failure to rescue events
Settles et al. (2011) – 148 healthcare professionals or students (73 high-fidelity, 75 traditional) from a hospital, school of nursing, school of medicine, or physicians' assistant program in the Midwest	classroom instruction in advanced cardiac life support with high-fidelity patient simulators or low-fidelity (monitor) simulation	no post-training difference between groups in knowledge or skills
Sharp & Lipsky (2002) – 315 physicians, physician assistants, nurses, and nurse practitioners from 8 states (California, Connecticut, Kentucky, Illinois, Michigan, New York, Oregon, Texas)	7-hour continuing medical education multicomponent program on type 2 diabetes	for allied professionals: more positive knowledge/attitude scores post program change did not persist at 3 months
Sherman et al. (2012) – 68 nurses in a hospital in North Carolina	average of 3.3 hours of online, interactive instruction or traditional lecture in critical care pharmacology	no posttest or between-group differences on cognitive learning
Smith & Buckwalter (1998) – 193 RNs and nursing assistants from nursing homes in Charlottesville area	geriatric mental health training in two forms: direct train and train the trainers	better posttest scores on a 77-item knowledge test for participants in the direct train group no difference in posttest knowledge scores for train the trainer participants
Smith et al. (1994) – 528 RNs and LPNs from 22 LTC facilities in 8 Iowa counties	2-day training program on geriatric mental health and illness for nursing personnel in rural settings	better posttest knowledge scores
Spiva et al. (2012) – 135 nurses in 5 hospitals of an integrated healthcare system in the Southeast	instruction in interpretation of basic electrocardiogram strips using 5 different teaching modalities (instructor-led course, e-learning with and without study time, e-learning plus facilitated debriefing with and without study time)	better posttest scores for all groups on an American Heart Association online electrocardiogram rhythm test
Straka et al. (2012)	instruction for novice nurses including	better posttest scores on

Table 3. Changes in Knowledge

Study:	Continuing Education:	Outcome(s):
– 26 nurses a hospital in Pennsylvania	simulation of patient scenarios to improve recognition and management of pediatric patients' symptoms during deterioration	<ul style="list-style-type: none">• recognizing clinical signs of decreased perfusion• ability to identify first signs of deterioration
Suggs et al. (1998) – 63 nurses (28 self-learning, 35 lecture/discussion) from various institutional settings in North Carolina and South Carolina	6- to 10-hour self-instruction package or 5-hour lecture and discussion workshop on geriatric pharmacology	better posttest scores for both groups on knowledge
Sumner et al. (2012) – 102 nurses (62 at follow up) in a hospital in Massachusetts	4-hour program for newly hired RNs on basic arrhythmia knowledge	better posttest scores on arrhythmia knowledge retention of knowledge at 3-month follow up as measured by identification of simulated arrhythmias in 8 scenarios
Sweeney et al. (2013) –17 nursing personnel from a kidney-pancreas transplant unit in a tertiary care center in California	60-minute didactic session and 30-minute hands-on session to set up and operate an insulin pump	better knowledge scores at posttest and 2-week follow up on ability to understand the indications and contraindications of pump therapy
Teri et al. (1991) – 487 Directors of Nursing, LPN, RN, and others, 143 experimental from 15 facilities and 344 control from 16 facilities not attending training	2-day training conference on specialized care for Alzheimer's patients	better scores on problem solving vignettes no difference on Alzheimer's information quiz
Tringali & Kanaskie (2012) – 48 nurses (47 RNs, 1 LPN) in a medical center in Pennsylvania	1-hour classroom session on assessment and management of oral mucositis for oncology patients	better posttest scores on knowledge
Valente & Murray (2011) – 30 nurses in a hospital in California	in-class and on-line presentations on medical safety, medication allergies, and adverse drug events, accompanied by distribution of educational information to patients	better posttest scores on knowledge questions
Wallace et al. (2006) – 18 nurses from hospitals, nursing homes, home care agencies, and other community providers in Connecticut	6 weekly 3-hour classes on common problems of aging and geriatric assessment	no posttest increases in total knowledge scores; posttest gains on some individual items in the 36-item measure

Table 3. Changes in Knowledge

Study:	Continuing Education:	Outcome(s):
Wallen et al. (2011) – 127 nurses and other allied health professionals (57 posttest) at a research hospital in Maryland	7 web-based self-education modules combined with monthly lectures on basic genetics	better posttest scores on knowledge
Wolak et al. (2008) – 14 nurses at academic medical center	grand rounds presentation on a clinically unique pathology found in burn patients	86% met or exceeded the pre-established definition of knowledge acquisition
Yong et al. (2011) – 51 nurses (22 experimental, 27 control) in a hospital in South Korea	5 weeks of training sessions on spiritual care	better posttest experiment scores on leadership practice knowledge measured by the Leadership Practice Inventory
Zahner et al. (2009) – 38 nurse preceptors (13 follow up) working in acute, primary, and long-term care settings	9 online modules over 2-4 weeks on developing knowledge and skills to be an effective practice-based preceptor for undergraduate nursing students	better posttest scores on knowledge decline in knowledge from posttest to follow up
Zurmehly (2013) – 44 nurses and 180 patients in a hospital in the Midwest	30-minute online self-study module and study materials in an educational toolkit for a nursing intervention of oral care for mechanically ventilated ICU patients	better post-education scores on oral care knowledge

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