

Supplemental Digital Content

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Supplemental Digital Appendix 1

Full Search Strategy Used in a 2012 Systematic Review to Identify Research Describing Leadership Training in Health Care Action Teams (search started 3/27/12 and concluded 4/12/12)

PubMed search strategy:

("Leadership"[MH] OR leadership[tiab] OR teamwork[tiab] OR "effective teams"[tiab] OR "management course"[tiab] OR "team training"[tiab]) AND ("Quality of Health Care"[Mesh] OR "Outcome Assessment (Health Care)"[MH] OR assessment[tiab] OR assess[tiab] OR performance[tiab] OR evaluation[tiab] OR evaluate[tiab] OR evaluated[tiab] OR validity[tiab] OR validation[tiab] OR measure[tiab] OR measurement[tiab] OR "Program Evaluation"[mh] OR ("educational status"[MeSH Terms] OR "education"[MeSH Terms]) OR "education"[Subheading] OR "pilot study"[tiab] OR training[tiab] OR "leadership development"[tiab]) AND ("Health Personnel"[Mesh] OR "Faculty"[Mesh] OR "Emergency Responders"[Mesh] OR "Students, Health Occupations"[Mesh] OR residents[tiab] OR "Internship and Residency"[mh] OR "care teams"[tiab] OR "Patient Care Team"[mh] OR "Hospital Rapid Response Team"[mh] OR "Students, Medical"[mh]) AND English[lang] AND Journal Article[ptyp] NOT ("duty hours"[All Fields] OR executive[All Fields])

CINAHL search strategy:

S23	S21 Limiters - English Language; Research Article; Exclude MEDLINE records
S21	S18 and S19 and S20
S20	(S7 or S8 or S9 or S10 or S11 or S12) OR (assessment OR assess OR performance OR evaluation OR evaluate OR measure OR measurement OR "leadership development" OR training)
S19	(S1 or S2 or S3) OR "care teams"
S18	(S4 or S5 or S6) OR ("team building" OR teamwork OR "effective teams")
S17	S13 and S14 and S15
S16	S13 and S14 and S15
S15	S7 or S8 or S9 or S10 or S11 or S12
S14	S4 or S5 or S6
S13	S1 or S2 or S3
S12	(MH "Teaching Methods+")
S11	(MH "Educational Measurement+")
S10	(MH "Validation Studies")
S9	(MH "Program Evaluation")
S8	(MH "Professional Competence+")
S7	(MH "Clinical Competence+")
S6	(MH "Team Building")
S5	(MH "Teamwork")
S4	(MH "Leadership")
S3	(MH "Faculty+")
S2	(MH "Multidisciplinary Care Team+")
S1	(MH "Health Personnel+")

Embase search strategy:

('rapid response team'/exp OR 'health care personnel'/exp OR 'medical personnel'/exp OR 'care team') AND (teamwork'/exp OR 'leadership'/exp OR training) AND ('competence'/exp OR 'outcome assessment'/exp OR 'performance measurement system'/exp OR 'validation study'/exp) AND [embase]/lim

PyscINFO search strategy:

(DE "Leadership" OR DE "Leadership Qualities" OR DE "Leadership Style" OR DE "Transformational Leadership" OR "team training" OR teamwork) AND ((DE "Measurement" OR DE "Achievement Measures" OR DE "Aptitude Measures" OR DE "Attitude Measurement" OR DE "Attitude Measures") OR (DE "Competence" OR DE "Professional Competence") OR (DE "Evaluation" OR DE "Course Evaluation" OR DE "Program Evaluation") OR (DE "Training")) AND ((((DE "Health Personnel" OR DE "Allied Health Personnel" OR DE "Medical Personnel" OR DE "Mental Health Personnel") OR (DE "Medical Students")) OR (DE "Medical Internship")) OR (DE "Medical Education") OR "care teams")

Web of Science search strategy:

Topic=(teamwork OR leadership OR "team training") AND Topic=("care providers" OR residents OR students OR nurse* OR physician* OR team OR teams OR faculty) AND Topic=(quality OR assessment OR competence OR evaluation OR metrics OR outcome OR validation OR pilot OR evaluated)
Timespan=1955-2012. Databases=SCI-EXPANDED, SSCI.

Full journal review

We included indices from relevant journal issues that were not fully indexed in PubMed/MEDLINE at the time of the search. *Teaching and Learning in Medicine* and *Medical Teacher* were hand searched from (1/2011 – 3/2012) as there was some concern that there was a delay in indexing based on the investigators' experience unrelated to this study. All 2006 issues of *Simulation in Healthcare* were hand searched to ensure that early issues published prior to inclusion in MEDLINE were included in the review, as they had not been retrospectively indexed at the time of the literature search.

Bibliography search

We searched full bibliographies from the following pertinent leadership-focused articles:

Klein KJ, Ziegert JC, Knight AR, Xiao Y. Dynamic delegation: Hierarchical, shared and deindividualized leadership in extreme action teams. *Administrative Science Quarterly*. Dec 2006;51(4):590-621.

Kunzle B, Kolbe M, Grote G. Ensuring patient safety through effective leadership behaviour: A literature review. *Safety Science*. Jan 2010;48(1):1-17.

Hunziker S, Johansson AC, Tschan F, et al. Teamwork and leadership in cardiopulmonary resuscitation. *J Am Coll Cardiol*. Jun 14 2011;57(24):2381-2388.

Parker SH, Yule S, Flin R, McKinley A. Towards a model of surgeons' leadership in the operating room. *BMJ Qual. Saf.* Jul 2011;20(7):570-579.

Supplemental Digital Table 1

Definition of Terms Used in a 2012 Systematic Review of Leadership Training in Health Care Action Teams

Term	Definition
Participants	
Health professions learner	Any undergraduate, graduate, fellow, board-eligible or licensed practitioner in a health care field, including physicians, nurses, physician assistants, respiratory therapists, medical assistants, and pre-hospital providers
Work team	Team consisting of two or more individuals who (1) share common goals, (2) are part of a larger organizational system, (3) are formed to execute organizational tasks, and (4) exhibit interdependencies with respect to workflow, goals, and outcomes.
Action team	Interdisciplinary work team whose members, improvise and coordinate their actions in time-pressured, unstable situations where the stakes are high (e.g., code team, surgical team, disaster management team).
Intervention training modality	
Simulation-based ^a	An educational intervention that utilizes any technology or process that recreates the contextual background of a health care environment, allowing providers the opportunity to experience an authentic clinical interaction with patients and other health care team members. This includes high and low-fidelity mannequins, part-task trainers, animal models, and virtual reality-based platforms.
Lecture-based	An educational intervention that involves delivery or discussion of curricular information in a non-immersive environment. This includes lecture and small group discussion.
Computer-based	An educational intervention using a standard computer or web-based interface. This specifically does not include virtual reality-based platforms (see Simulation-based training above).
Outcomes	
Participant perceptions	Subjective assessment of participants' (1) feelings about the training, (2) perceived improvement in knowledge, skills, or behaviors, or (3) self-reported transfer of behavior to the workplace. This does not include assessments that focus only on training logistics (e.g., room size, comfort, duration, etc).
Modifications of knowledge or skills	Objective measurement of either knowledge or skills using a formally designed assessment platform (written exam, objective structured clinical exam, high fidelity simulation-based assessment, etc)
Behavior change	Objective assessment of change in participant behavior/skills that transferred to the actual work (clinical) environment
Patient or system-level impact	Objective assessment of the impact of training on health care delivery, i.e., change in organizational delivery or quality of patient care
Study design^b	
Descriptive	Study describes the development and/or implementation of a curriculum.
Single group post-test	A single group received training, followed by a single assessment or series of assessments.
Single group pre-/post-test	A single group was assessed at least once both before and after training.
Two-group, non-randomized	Comparisons made between two or more non-randomized groups. Comparisons could be pre- and post-training or post-training only.
Randomized controlled or comparison trial	Comparisons made between two or more randomized groups. Comparisons could be pre and post-training or post-training only.

Validity evidence^c

Content validity	Evaluation of the degree to which the instrument accurately and completely represent the construct being assessed.
Internal structure	Evaluation of (1) reliability (inter-rater agreement, internal consistency, temporal stability, parallel forms) and/or (2) factor analysis data of the instrument.
Relationship to other variables	Evaluation of the degree to which the assessment correlates with other measures of performance, or expected developmental/experiential patterns. Other variable must be one that would logically be expected to correlate to outcome assessed.

^aDefinition adapted from Bradley P. The history of simulation in medical education and possible future directions. Medical Education. 2006;40:254-262.

^bDefinitions adapted from Fraenkel J, Wallen N. How to Design and Evaluate Research in Education. Boston, Mass: McGraw-Hill; 2008.

^cDefinitions adapted from Cook DA, Beckman TJ. Current concepts in validity and reliability for psychometric instruments: Theory and application. The American Journal of Medicine. 2006;119(2):166 e167-e116.

Supplemental Digital Table 2

Leadership Behaviors Listed by Study From a 2012 Systematic Review of Leadership Training in Health Care Action Teams

Study first author, publication year ^{ref a}	Source of curriculum	Leadership behaviors targeted during training ^b	
Leadership as primary focus of training			
Cooper, 2001 ³⁸	N/A	<div><div>1.</div><div>Lets the team know what was expected of them</div></div> <div><div>2.</div><div>Demonstrates the use of uniform guidelines</div></div> <div><div>3.</div><div>Displays a positive attitude throughout the scenario</div></div> <div><div>4.</div><div>Decides what should be done</div></div> <div><div>5.</div><div>Decides how things should be done</div></div>	<div><div>6.</div><div>Allocates tasks to specific individuals</div></div> <div><div>7.</div><div>Makes sure that his/her part in the team is understood by the team members</div></div> <div><div>8.</div><div>Plans the work to be done</div></div> <div><div>9.</div><div>Maintains definite standards of performance</div></div> <div><div>10.</div><div>Remains 'hands off' throughout the scenario</div></div>
Gilfoyle, 2007 ⁴⁵	N/A	<div><div>1.</div><div>Assigns roles</div><div><div>a.</div><div>Declares he/she is in charge</div></div><div><div>b.</div><div>Divides (PALS) algorithm into distinct steps</div></div><div><div>c.</div><div>Recognizes skill set of each member and matches members' skill set with tasks</div></div><div><div>d.</div><div>Announces roles to whole team</div></div></div> <div><div>2.</div><div>Assess limitations of team members</div><div><div>a.</div><div>Anticipate difficulty of tasks</div></div><div><div>b.</div><div>Compares skills of team members with difficulty of task</div></div></div> <div><div>3.</div><div>Based on limitations, formulates plan to add skill to team if needed</div></div> <div><div>4.</div><div>Continuously reassess and re-evaluate progress using all available info</div><div><div>a.</div><div>Acknowledges response to treatment</div></div><div><div>b.</div><div>Avoids fixation error</div></div><div><div>c.</div><div>Generates list of reasons why desired result isn't seen</div></div><div><div>d.</div><div>Solves problems</div></div></div>	<div><div>5.</div><div>Demonstrate another approach when expected results not happening</div></div> <div><div>6.</div><div>Critically evaluates team members and redirects as needed</div></div> <div><div>7.</div><div>Displays effective communication</div><div><div>a.</div><div>Calm, clear voice</div></div><div><div>b.</div><div>States commands clearly</div></div><div><div>c.</div><div>Uses closed loop communication</div></div><div><div>d.</div><div>Encourages open exchange with team members</div></div><div><div>e.</div><div>Defers dealing with conflict unless impacting team</div></div><div><div>f.</div><div>Quickly manages disruptive behavior</div></div></div>
Hunziker, 2010 ⁴⁹	N/A	<div><div>1.</div><div>Assign and distribute task according the algorithm</div></div> <div><div>2.</div><div>Decide what to do</div></div> <div><div>3.</div><div>Ensures adherence to your instructions and to the algorithm</div></div>	<div><div>4.</div><div>Check if the team's performance adheres to the algorithm</div></div> <div><div>5.</div><div>Make short and clear statements</div></div>

Stefan, 2011 ⁶⁹	N/A	<ol style="list-style-type: none"> 1. Team member performance monitoring 2. Task delegation/ clearly defines roles and responsibilities (assign tasks) 3. Closed-loop communication 4. Systematic approach to assessment and management 5. Reevaluation of the situation 6. Organizes the group 7. Backs up team members 8. Clear messages / concise communication 	<ol style="list-style-type: none"> 9. Knowledge sharing to facilitate understanding 10. Avoids getting involved in procedures or other tasks 11. Crowd control 12. Position self to ensure can watch monitor at all times 13. Ask (other team members) for suggestions
Leadership as a component of teamwork training			
Andreatta, 2011 ²⁹	N/A	<ol style="list-style-type: none"> 1. Team leader identified 	
Capella, 2010 ³⁵	N/A	<ol style="list-style-type: none"> 1. Identify all team members 2. Assess the available information 3. Create preliminary patient care plans 	
Clark EA, 2010 ³⁷	N/A	<ol style="list-style-type: none"> 1. Clearly identifies team leader 2. Maintains a "big picture" perspective 3. Uses "out loud" communication to maintain shared mental model 	
Dagnone, 2008 ³⁹	N/A	<ol style="list-style-type: none"> 1. Does initial (ACLS) assessment 2. Calls for help 3. Delegates specific tasks 	<ol style="list-style-type: none"> 4. Speaks clearly without shouting 5. Gives very specific instructions
Deering, 2011 ⁴⁰	TeamSTEPPS	<ol style="list-style-type: none"> 1. Coordinates activities of team members 2. Ensures team actions are understood 3. Ensures changes in information are shared 4. Ensures team members have the necessary resources 	
Dorney, 2011 ⁴¹	N/A	<ol style="list-style-type: none"> 1. The qualified individual assumes the role of code team leader 2. Directs resuscitation efforts, patient management 3. Communicates clearly with all members of the team 4. Organizes the group 	<ol style="list-style-type: none"> 5. Monitors the performance of team members 6. Models exceptional behavior 7. Facilitates understanding 8. Coaches 9. Focuses on comprehensive patient care
Freeth, 2009 ⁴³	N/A	<ol style="list-style-type: none"> 1. Leadership appropriate for situation and team members 	
Mayo, 2011 ⁵⁷	N/A	<ol style="list-style-type: none"> 1. Provides direction 2. Prepares equipment 3. Performs task (intubation) 	
McLaughlin, 2011 ⁵⁸	N/A	<ol style="list-style-type: none"> 1. Effectively monitor and direct team members 	
Riley, 2011 ⁶⁶	TeamSTEPPS	<ol style="list-style-type: none"> 1. Able to coordinate team member activities 2. Manages resources available to team members 3. Communicates plans 	<ol style="list-style-type: none"> 4. Provides information about team performance through debriefs 5. Provides support to team members when needed
Small, 1999 ⁶⁸	N/A	<ol style="list-style-type: none"> 1. Takes a leadership role 	

van Schaik, 2011 ⁷¹	N/A	1. Identifies team leader role 2. Appropriately delegates and assigns roles to others 3. Summarizes and categorizes	4. Makes prompt and firm decisions 5. Communicates with team effectively
Wallin, 2007 ⁷⁴	N/A	1. Assumes leadership role	
Weaver, 2010 ⁷⁵	TeamSTEPPS	1. Discusses critical issues and emerging events 2. Anticipates outcomes and likely contingencies 3. Assigns resources	4. Expresses concerns 5. Verbalizes changes in plans (changes in strategy, intervention, or timeline) 6. Distributes tasks or assignments to specific team members
Wisborg, 2008 ⁷⁷	BEST	1. Distributes workload 2. Oversees patient care 3. Crosschecks information	4. Shares information 5. Assesses patient status 6. Takes responsibility

Abbreviations: N/A, not applicable; TeamSTEPPS, Team Strategies and Tools to Enhance Performance and Patient Safety; BEST, Better and Systematic Trauma Care.

^aFor full citations, see reference list at the end of the article.

^bLeadership training behaviors listed in study. If a study adapted or modified another curriculum, the leadership behaviors are not listed unless the author noted clearly how they were adapted.

Supplemental Digital Table 3

Characteristics of 45 Studies Evaluating the Impact of Leadership Training Identified in a 2012 Systematic Review of Leadership Training in Health Care Action Teams

Study first author, publication year ^{ref a}	Study design	Focus of assessment	Number assessed	Response rate ^b	Validity evidence			MERSQI score
					Content validity	Internal structure	Relationship to other variables	
Leadership Trained as Primary Focus								
Cooper, 2001 ³⁸	RCT	Leadership	NR	>75%	Lit	NR	Reported	13.5
Gilfoyle, 2007 ⁴⁵	Single group pre/post test	Leadership	15 individuals	>75%	NR	NR	NR	10
Hunziker, 2010 ⁴⁹	RCT	Teamwork (with leadership)	63 teams	>75%	Lit	IRR	Reported	14.5
Knudson, 2008 ⁵²	RCT	Teamwork (with leadership)	10 individuals	50-74%	NR	IRR	NR	13.5
Stefan, 2011 ⁶⁹	Single group pre/post test	Teamwork (with leadership)	24 individuals	<50% or NR	NR	NR	NR	6.5
Leadership Trained as a Component of Teamwork								
Andreatta, 2011 ²⁹	Single group pre/post test	Teamwork (with leadership)	228 individuals	<50% or NR	NR	NR	NR	11.5
Armour Forse, 2011 ³⁰	Single group pre/post test	Other	NR	<50% or NR	Lit	NR	NR	11.5
Birch, 2007 ³²	RCT	Other	6 teams	>75%	NR	TS; IRR	NR	12.5
Blum, 2004 ³³	Single group post test	Other	55 individuals	>75%	NR	NR	NR	7
Bradley, 2009 ³⁴	Single group pre/post test	Teamwork (with leadership)	51 individuals	>75%	Lit	TS; IRR	Reported	15
Capella, 2010 ³⁵	Single group pre/post test	Teamwork (with leadership)	40 teams	<50% or NR	NR	NR	NR	10.5
Catchpole, 2010 ³⁶	Single group pre/post test	Teamwork (with leadership)	61 teams	<50% or NR	Lit	IRR	NR	13.5
Dagnone, 2008 ³⁹	Single group post test	Other	144 individuals	>75%	NR	NR	NR	7
Deering, 2011 ⁴⁰	Single group pre/post test	Other	N/A	N/A	NR	N/A	NR	13
Fernandez-Castelano, 2011 ⁴²	RCT	Teamwork (with leadership)	44 teams	>75%	Lit; SME	IRR	NR	13.5
Freeth, 2009 ⁴³	Single group post test	Other	55 individuals	50-74%	NR	NR	NR	7.5

Frengley, 2011 ⁴⁴	RCT	Teamwork (with leadership)	40 teams	>75%	Lit	IRR	NR	14.5
Halverson, 2009 ⁴⁶	Single group pre/post test	Teamwork (with leadership)	76 teams	<50% or NR	NR	NR	NR	9.5
Hansen, 2007 ⁴⁷	Single group pre/post test	Teamwork (no leadership)	79 individuals	>75%	NR	NR	NR	8.5
Hobgood, 2010 ⁴⁸	RCT	Teamwork (with leadership)	32 teams	<50% or NR	Lit	IRR	NR	14
Jankouskas, 2007 ⁵⁰	Single group pre/post test	Teamwork (no leadership)	7 teams	>75%	Lit	NR	Reported	12
Jankouskas, 2011 ⁵¹	RCT	Teamwork (with leadership)	24 teams	>75%	Lit	IRR	Reported	15.5
Malec, 2007 ⁵⁴	Single group pre/post test	Teamwork (with leadership)	273 teams	>75%	Lit	IC; IRR	NR	10.5
Malekzadeh, 2011 ⁵⁵	Single group pre/post test	Other	27 individuals	>75%	NR	NR	NR	8.5
Mayer, 2011 ⁵⁶	Single group pre/post test	Teamwork (with leadership)	195 individuals	<50% or NR	Lit	IRR	NR	13.5
Mayo, 2011 ⁵⁷	Single group post test	Other	NR	>75%	Lit	NR	NR	12
McLaughlin, 2011 ⁵⁸	Single group post test	Teamwork (with leadership)	35 individuals	<50% or NR	Lit	NR	NR	7
Morey, 2002 ⁵⁹	Two group non-randomized,	Teamwork (no leadership)	9 teams	>75%	Lit	IC; IRR	NR	16
Nadel, 2000 ⁶⁰	Two group non-randomized,	Teamwork (with leadership)	50 individuals	>75%	SME	NR	NR	11.5
Nadler, 2011 ⁶¹	Single group pre/post test	Other	NR	>75%	Lit	NR	NR	12
Pascual, 2011 ⁶²	Single group pre/post test	Teamwork (with leadership)	12 individuals	>75%	Lit	IRR	Reported	13.5
Peckler, 2012 ⁶³	Single group pre/post test	Teamwork (with leadership)	41 individuals	>75%	Lit; SME	IRR	NR	9.5
Pliego, 2008 ⁶⁴	Single group post test	Teamwork (with leadership)	18 individuals	>75%	NR	NR	NR	7
Reznek, 2003 ⁶⁵	Single group post test	Other	12 individuals	<50% or NR	NR	NR	NR	6
Riley, 2011 ⁶⁶	RCT	Other	NR	<50% or NR	Lit	NR	NR	15
Robertson, 2010 ⁶⁷	Single group pre/post test	Teamwork (no leadership)	192 individuals	<50% or NR	Lit	NR	NR	10

Ten Eyck, 2010 ⁷⁰	RCT	Other	68 individuals	>75%	NR	IRR	NR	12.5
van Schaik, 2011 ⁷¹	Single group pre/post test	Teamwork (with leadership)	449 individuals	<50% or NR	Lit	NR	Reported	9.5
Varkey, 2009 ⁷²	Single group post test	Teamwork (with leadership)	1 team	>75%	Lit; SME	IC	Reported	12.5
Volk, 2011 ⁷³	Single group post test	Other	59 individuals	>75%	NR	NR	NR	7
Wallin, 2007 ⁷⁴	Single group pre/post test	Teamwork (with leadership)	15 teams	>75%	Lit	IRR	Reported	13
Weaver, 2010 ⁷⁵	Two-group non-randomized,	Teamwork (with leadership)	55 individuals	<50% or NR	Lit	IRR	NR	13
Wisborg, 2008 ⁷⁷	Single group pre/post test	Other	1368 individuals	<50% or NR	NR	NR	NR	7.5
Youngblood, 2008 ⁷⁸	RCT	Teamwork (with leadership)	30 individuals	>75%	Lit	IC; IRR	NR	15
Zausig, 2009 ⁷⁹	RCT	Teamwork (with leadership)	42 individuals	>75%	Lit; D	IRR	Reported	16.5

Abbreviations: RCT, randomized controlled or comparison trial; NR, not reported; N/A, not applicable; Lit, literature review; SME, subject matter expert review; D, Delphi process; IC, internal consistency; TS, temporal stability; IRR, inter-rater agreement; MERSQI, Medical Education Research Study Quality Instrument.

^aFor full citations, see reference list at the end of the article.

^b Response rate is defined as the percentage of trained participants that completed the assessment.