



Outcomes of a Revised Apprentice Carpenter Fall Prevention Training Curriculum

Vicki Kaskutas and Barry Stelzer

V Kaskutas, B Evanoff, AM Dale, H Lipscomb, J Gaal, M Fuchs,
CJAP Apprenticeship Instructors

Washington University School of Medicine
Carpenters' District Council of Greater St. Louis and Vicinity
Carpenters' Joint Apprenticeship Program of St. Louis

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Research Collaborators

- ▶ Washington University School of Medicine
- ▶ Duke University
- ▶ Carpenters District Council
 - Currently 900 apprentice members, was 2,400
 - 90% of residential workforce in STL is unionized
- ▶ Carpenters' Joint Apprenticeship Program
 - Apprentices work residential, commercial or both
 - Jointly supported by the union and local contractors
 - Instructors are journeymen with college degree
 - 4-year on-the-job training program
 - Attend 2-week training sessions every 6 months
 - Facilities include classrooms and large shops





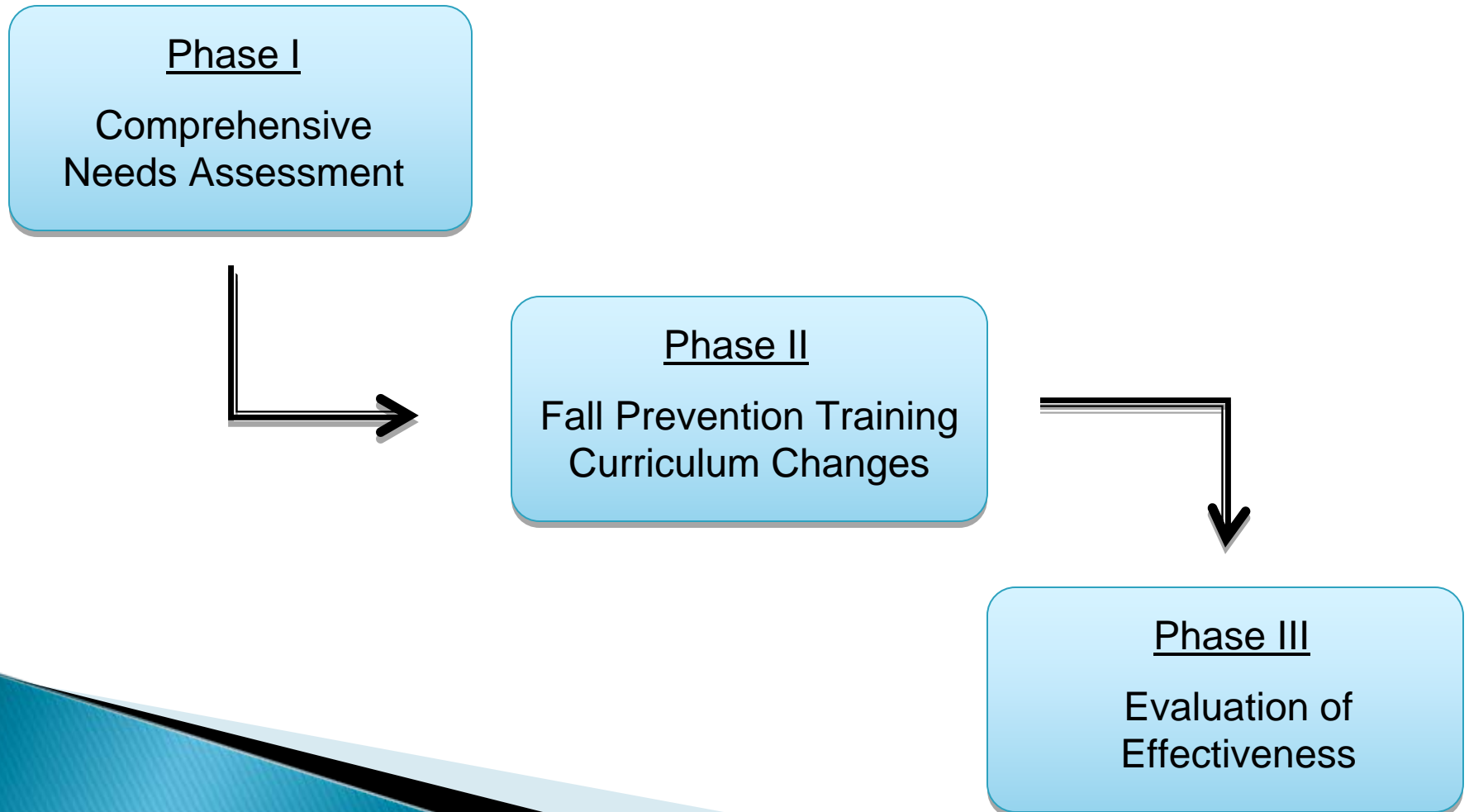
Background

- ▶ Construction is a dangerous industry
 - 1,178 fatal work injuries in 2007 (BLS 2007)
 - 35% fatalities due to falls
- ▶ Residential construction
 - 43% fatalities due to falls (BLS 2007)
 - Challenges in residential construction
 - Small work crews, fast-paced
 - No permanent job sites, geographically dispersed, rapidly changing environment
- ▶ Falls remain a leading cause of morbidity and mortality in construction



Fall Prevention Project

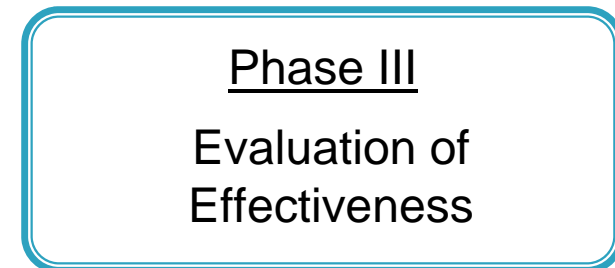
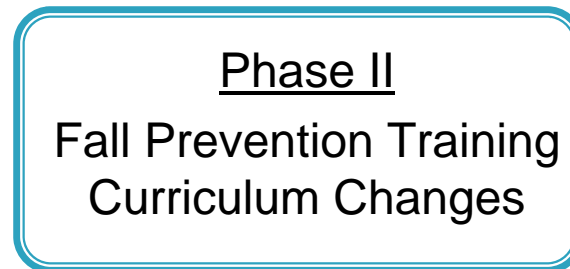
Use the results from comprehensive needs assessment to improve the fall prevention curriculum at carpenters' apprenticeship training program.



Methods-Phase I



- ▶ Current Fall Prevention Training
- ▶ Focus Groups
- ▶ Residential Worksite Audits
- ▶ Questionnaires



Needs Assessment

- ▶ 5 focus group of apprentices at different stages of training
 - 36 total participants
- ▶ 197 worksite audits
 - 510 brief worker surveys
 - 95.5% of those asked for interviews agreed
- ▶ 1,025 questionnaires
 - 98.8% response rate





Results - Focus Groups

- ▶ Work at heights early in career
- ▶ Apprentices perform many tasks prior to training, including tasks at elevations
- ▶ Frequently assigned high risk tasks
- ▶ Crewmembers frequently perform tasks unsafely & instruct them to do the same
- ▶ Are hesitant to ask for instruction or to question methods that appear unsafe
- ▶ Fear layoff if refuse to do a task they don't know how to do or they think is too risky



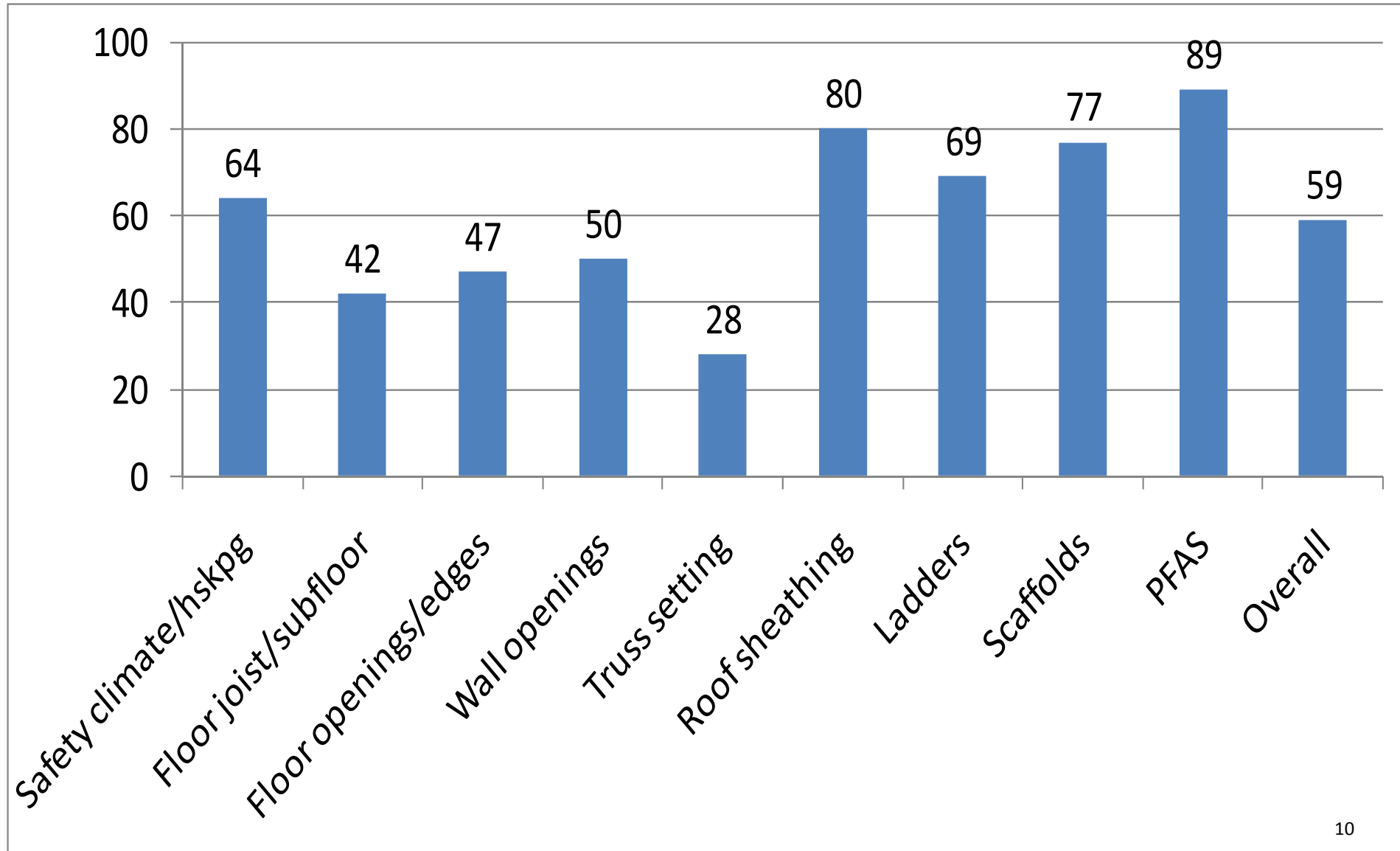


Worksite Audits

- ▶ 52-item observational audit – St. Louis Audit of Fall Risks (SAFR)
 - General Safety (3)
 - Floor Joist & Sub-floor (3)
 - Floor Opening (6)
 - Wall Opening (2)
 - Truss Setting (6)
 - Roof Sheathing (7)
 - Ladders (10)
 - Scaffolds (13)
 - Personal Fall Arrest (2)
- ▶ Brief worker interview
- ▶ Trained carpenters perform audit
- ▶ All or none scoring
 - Meets safety criteria
 - Does not meet criteria
 - Not observed during audit
- ▶ Mean domain scores computed
- ▶ Electronic Library of Construction Safety & Health
 - <http://www.elcosh.org/>

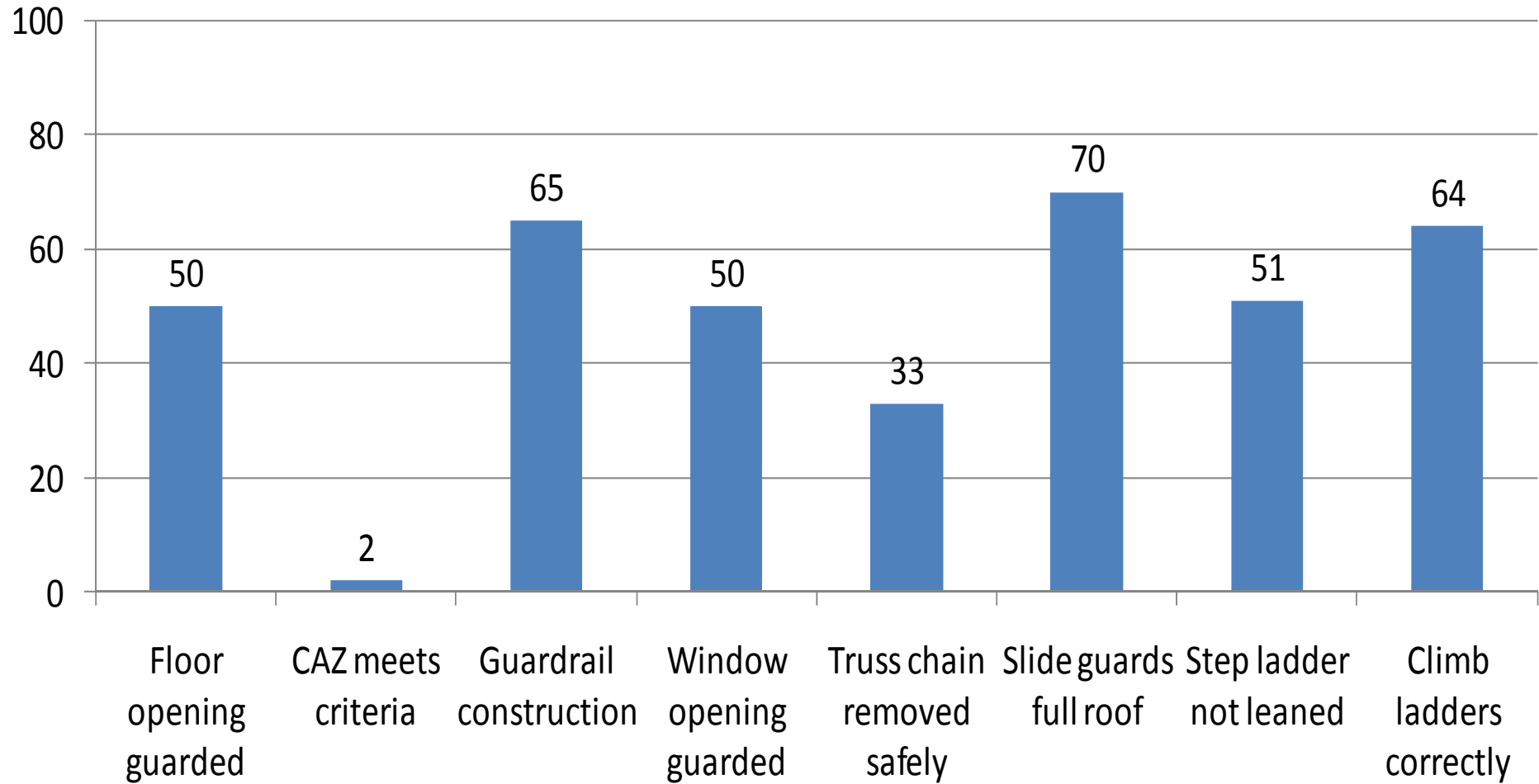


Percent of Time Observed Behaviors Met Audit Safety Criteria



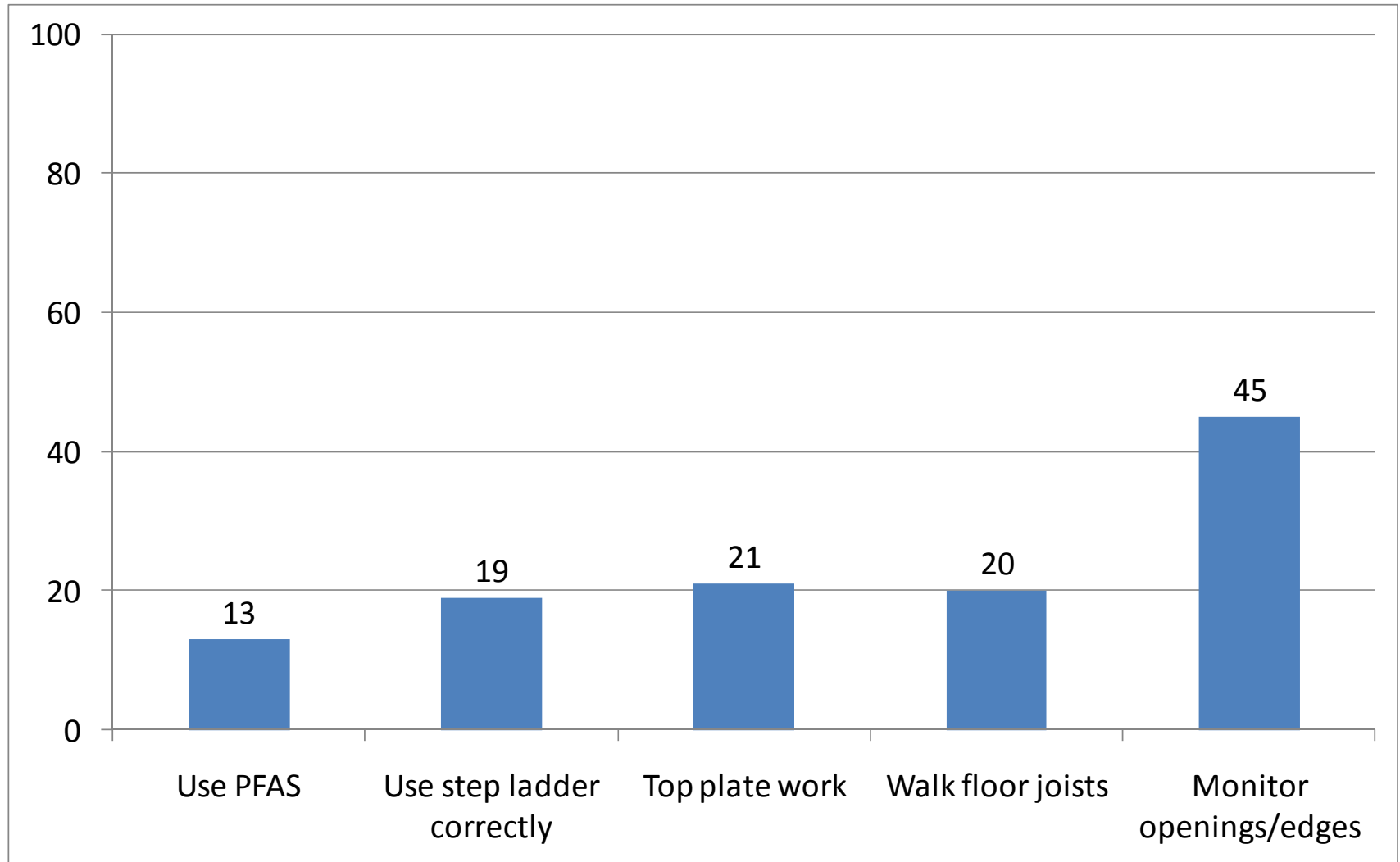


Percent of Time Observed Behaviors Met Audit Safety Criteria





Percent of Time Apprentices Reported Safe Crew Behaviors





Questionnaire Results: Fall Statistics



▶ Falls

- 16% fell from height in previous year
- 51% knew someone who had fell from height in last year
- 29% of all falls were from ladders, 18% truss/top plate, 17% floor openings

▶ Those who fell

- Fewer journeymen on site for mentorship
- 40% more likely to report unsafe crew behaviors
- Twice as likely to work residential construction

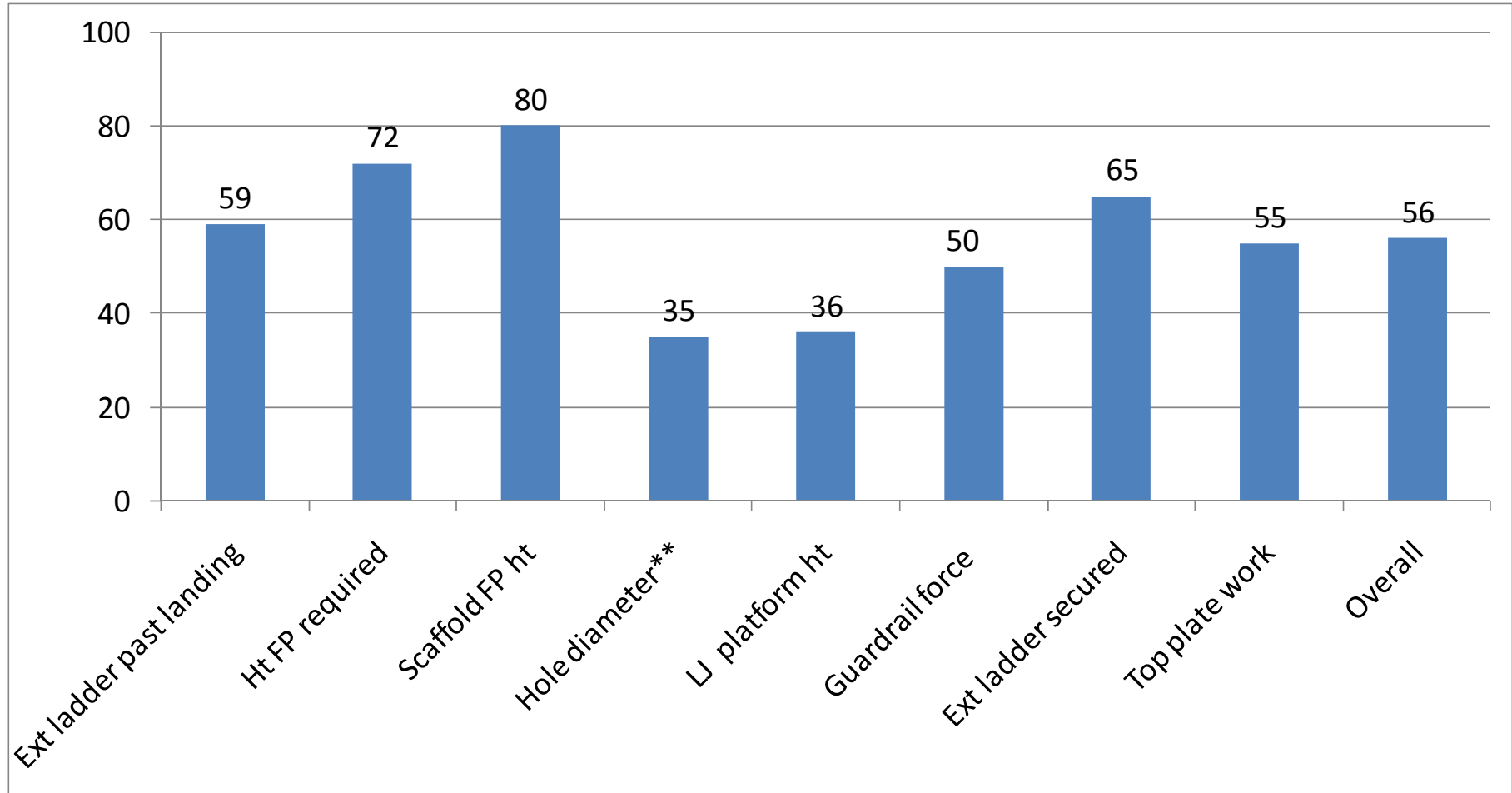
Questionnaire Results

- ▶ Risk perceptions by task
 - Steep pitch roofs
 - Setting trusses
 - Working on the top plate
 - Unprotected openings
 - Ladders perceived as low risk
- ▶ Confidence is high
 - Feel they can prevent themselves from falling
 - Feel they can perform work tasks safely



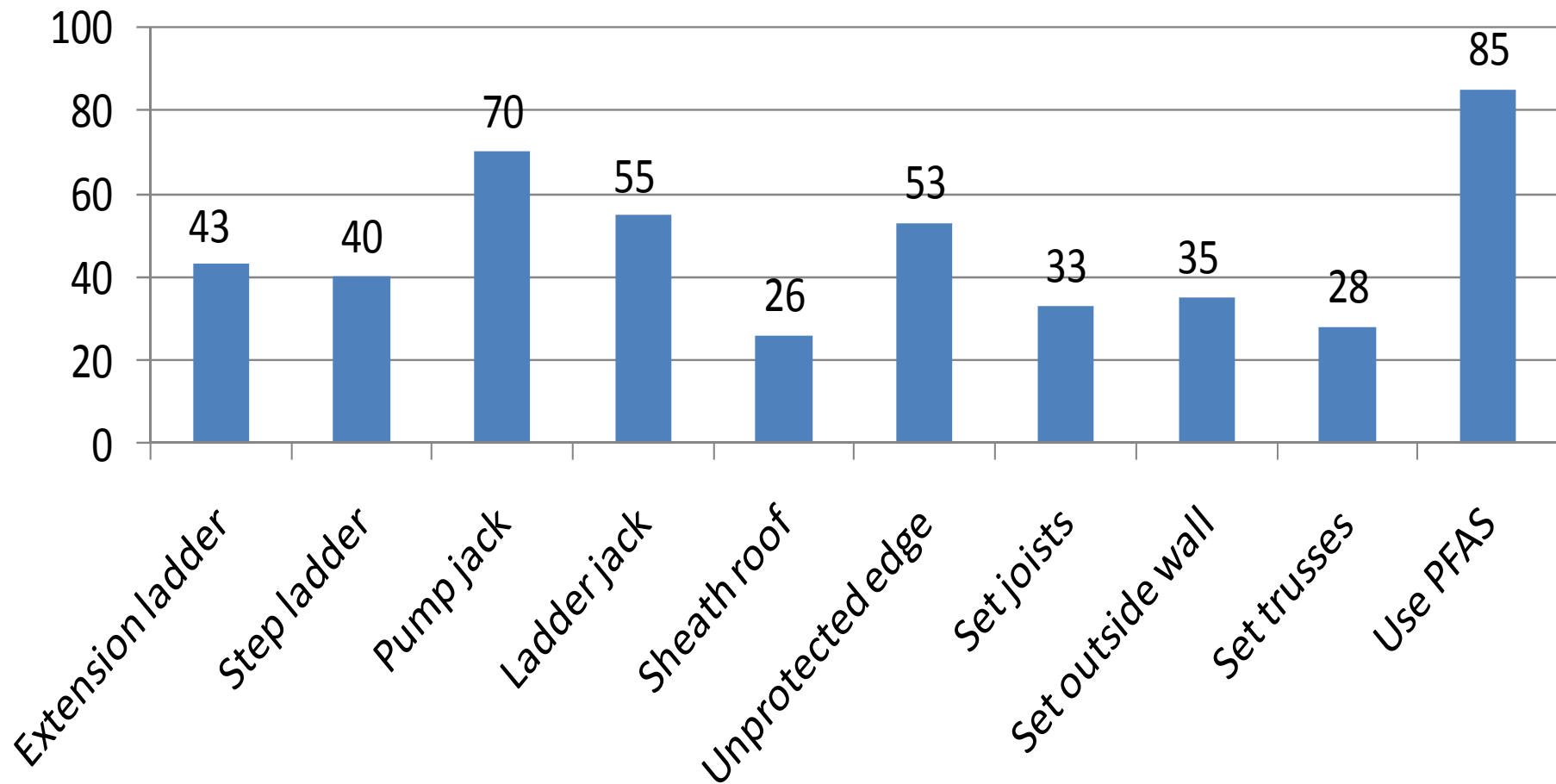


Percent of Apprentices who Knew OSHA Standard





Percent of Apprentices Reporting Trained at School Prior to Performing Task at Work



Training Preferences

- ▶ Apprentices like
 - Learning by doing
 - Practicing tasks and skills in shop
 - Real world examples and stories

- ▶ Apprentices dislike
 - Reading the OSHA regulation book
 - Listening to long lectures
 - Sitting in a classroom





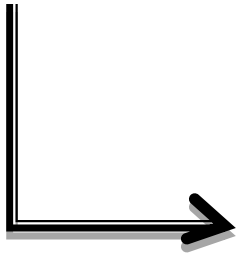
Needs assessment results for ladders

- ▶ Most falls occur from ladders
- ▶ Ladders used frequently at the worksite
- ▶ Most apprentices not trained to use ladders
- ▶ Ladder knowledge is lacking
- ▶ Ladders perceived least risky work task
- ▶ Many unsafe ladder behaviors reported
- ▶ Many unsafe ladder behaviors observed



Methods-Phase II

Phase I
Comprehensive
Needs Assessment



Phase II
Fall Prevention
Training Curriculum
Changes

- ▶ Develop
- ▶ Integrate
- ▶ Monitor

Phase III
Evaluation of
Effectiveness



Training Priorities - Phase II

- ▶ Frequently performed tasks
 - Tasks performed early in career
 - Tasks performed prior to receiving training
 - Tasks reported/observed as unsafe during audits

- ▶ Priority tasks include:
 - Ladder use – 9 objectives
 - Floor openings – 6 objectives
 - Truss setting – 8 objectives
 - Scaffold use – 5 objectives





Training Methods

- ▶ Use participatory, hands-on learning
- ▶ Practice tasks in real-world setting
- ▶ Limit lecture & reading OSHA standards
- ▶ Present in classroom 1st, then perform in shop
- ▶ Share fall stories to personalize
- ▶ Use small group discussion to problem-solve
- ▶ Focus on attitudes, beliefs, risk perceptions
- ▶ Use repetition & reinforcement
- ▶ Empower apprentices to identify safe work methods & consistently use them on the job







Target Curriculum Areas

- ▶ New apprentices (Introduction)
 - 18 training objectives
- ▶ 6 month apprentices (Health & Safety)
 - 8 training objectives
- ▶ 1st year apprentices (Residential Framing)
 - 6 training objectives
- ▶ 3rd year apprentices (Scaffolding & Rigging)
 - 9 training objectives



New Apprentice Training

Area	Before	After
Openings Edges	Discuss guardrail CAZ's not addressed	Guardrails – discuss when/where guardrail needed, show how to install safety boot, test to 200# Leading edges – show CAZ line, discuss CAZ monitoring, training & restricted access Holes – discuss 2" definition of hole, show how to cover hole w/ board & hole coverer Joists – discuss how to install floor joists from ladder, not plate



New Apprentice Training

Area	Before	After
General Fall Safety	Brief discussion	Discuss fall stats, sort worksite pictures by risk & discuss in groups, show CPWR fall DVD
Ladder Safety	Brief discussion	practice set-up/climbing step/ext ladders w/ instructor feedback
Truss Safety	Discuss in class	In addition to discussion, will point out on prop how to set/secure truss from ladder w/o walking on top plate



New Apprentice Training

Area	Before	After
Scaffold Safety	30-min shop training	In shop identify different types of scaffolding & risks associated with scaffold use
PFAS	Apprentices choose & apply	Apprentices choose & apply PFAS, instructor checks if properly applied
General Fall Safety	Brief discussion	Discuss fall stats, sort worksite pictures by risk & discuss in groups, show CPWR fall DVD







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New Apprentice Training

Area	Before	After
Scaffold Safety	30-min shop training (LJ, PJ, Bakers)	In shop identify different types of scaffolding & risks associated with scaffold use
PFAS	Apprentices choose & apply	Apprentices choose & apply PFAS, instructor checks if properly applied









6 Month Apprentice Training

Area	Before	After
General Fall Protection	OSHA 1926 lecture, fatality pictures, stories	Present fall prevention methods specific to residential construction, choose best fall protection method for various scenarios, CAZ requirements
PFAS	Lecture, free fall distance computed, instructor demo	In addition to classroom activities each student chooses, inspects, applies PFAS & climbs LJ, attaches to lifeline



6 Month Apprentice Training

Area	Before	After
Ladder Safety	Highlight in OSHA book, share ladder stories	Share ladder stories, show ladder movie, inspect/set/climb step/extension ladders, discuss how to work from ladders
Scaffold Safety	Lecture, highlight in OSHA book, stories, pictures	Scaffold hazards shown & discussed, in the shop students climb LJ & tie off, discuss PJ, students erect welded tubular frame scaffold & climb
Truss Safety	Briefly mentioned	Hook up gable truss & single trusses w/ crane & set in place





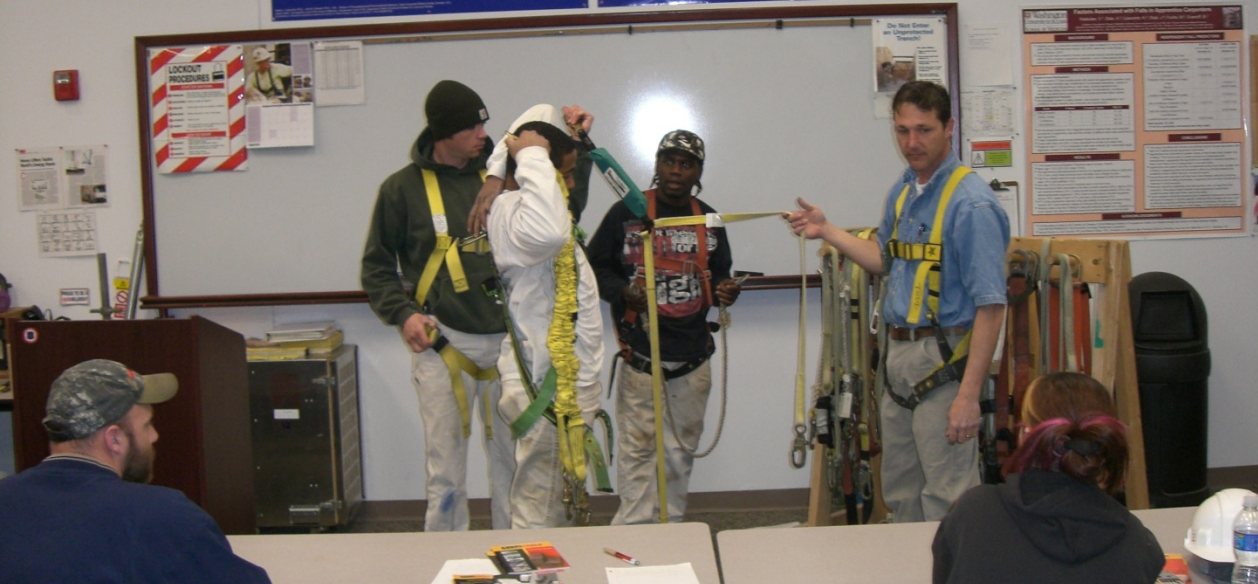


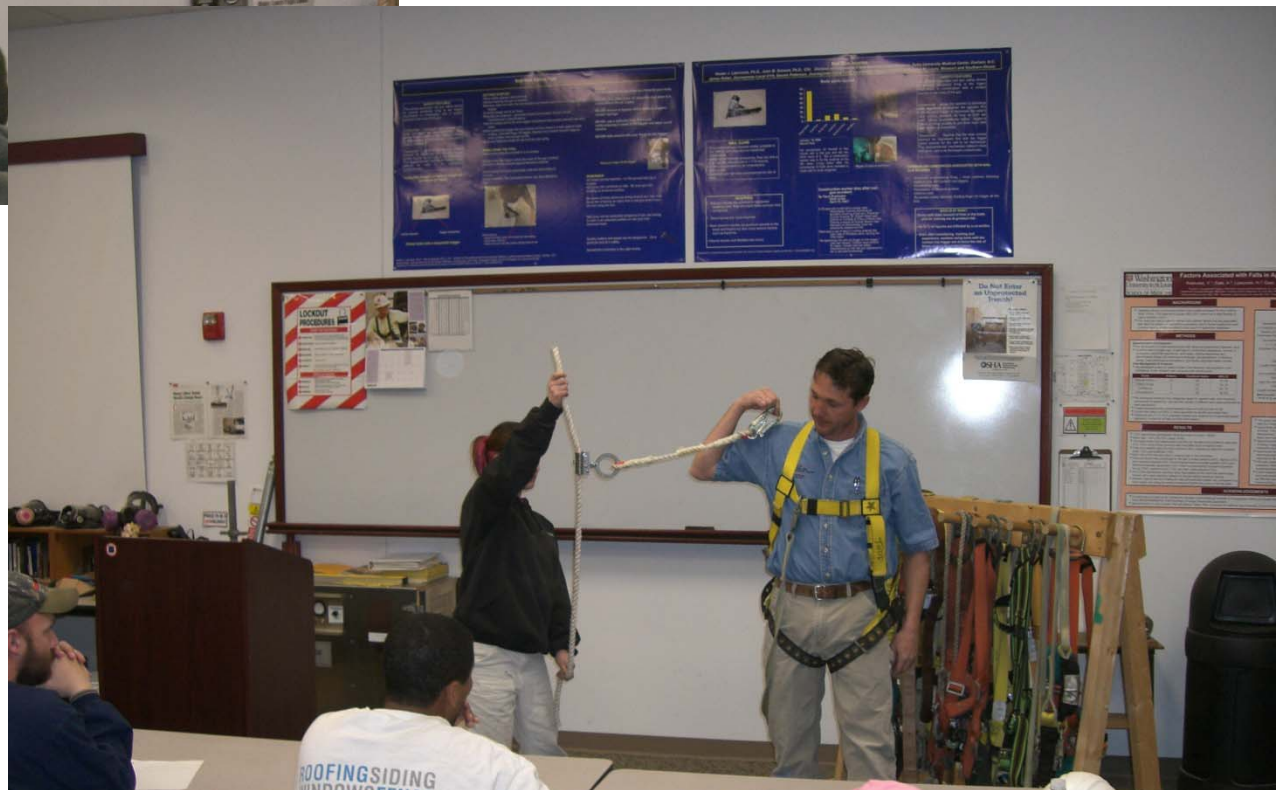
6 Month Apprentice Training



Area	Before	After
PFAS	Lecture, free fall distance computed, instructor demo	In addition to classroom activities each student chooses, inspects, applies PFAS & climbs LJ, attaches to lifeline













1st Year Apprentice Training

- ▶ **Sub-floor framing:** discuss leading edges & covering stairwell opening
- ▶ **Wall framing:** discuss guarding window/door openings, covering HVAC holes & not walking ladder blocks
- ▶ **Roof framing:** 20-minute discussion of fall prevention methods, fall story shared, show pictures of correct way to set truss, brace & install stay lap, discourage top plate standing
- ▶ **In shop:** inform students of safety rules and deduct points from shop grade for all violations







3rd Year Apprentice Training



▶ Scaffolding

- Use of ladders, guard rails & PFAS as they relate to scaffolding standards are presented
- Students choose correct size ladder, set, & climb while erecting scaffolding
- While erecting scaffold proper fall practices are used
- Students identify violations in scaffold pictures, discuss what led to the violation, and how to abate the violation

▶ Rigging

- Use of crane, hoists & chain falls practiced in the shop
- Crane setup and truss hook up procedures shown
- Discuss the hook-up, moving & landing of trusses



Monitoring Results - Phase II

- ▶ Monitor curriculum delivery
 - Note variations in training each time delivered
 - If change improved training integrate into lesson plans for future sessions
- ▶ Monitor objective achievement
 - Initially only 73% in Term 2
 - Modified objectives to be more realistic
 - Overall 90% objective achievement rate
- ▶ Continue to modify delivery method and objectives to best meet needs of apprentices and instructors

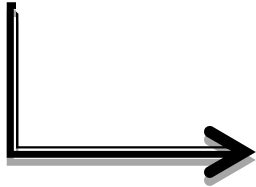


Monitoring Results - Phase II

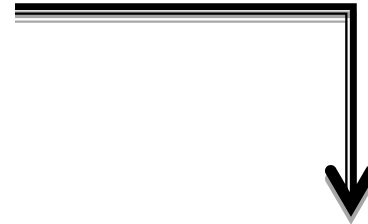
- ▶ Focus groups for apprenticeship feedback:
 - 96% felt that the prop is an effective training tool
 - 81% stated they will change their work habits
- ▶ Quotes from apprentices:
 - “I will use these safety tactics daily, I had no knowledge of them before.”
 - “I learned a lot about my own interpretation of risks.”
 - “You scared the heck out of me by telling me all the ways I’m going to die!”

Phase III

Phase I
Comprehensive
Needs Assessment



Phase II
Fall Prevention Training
Curriculum Changes

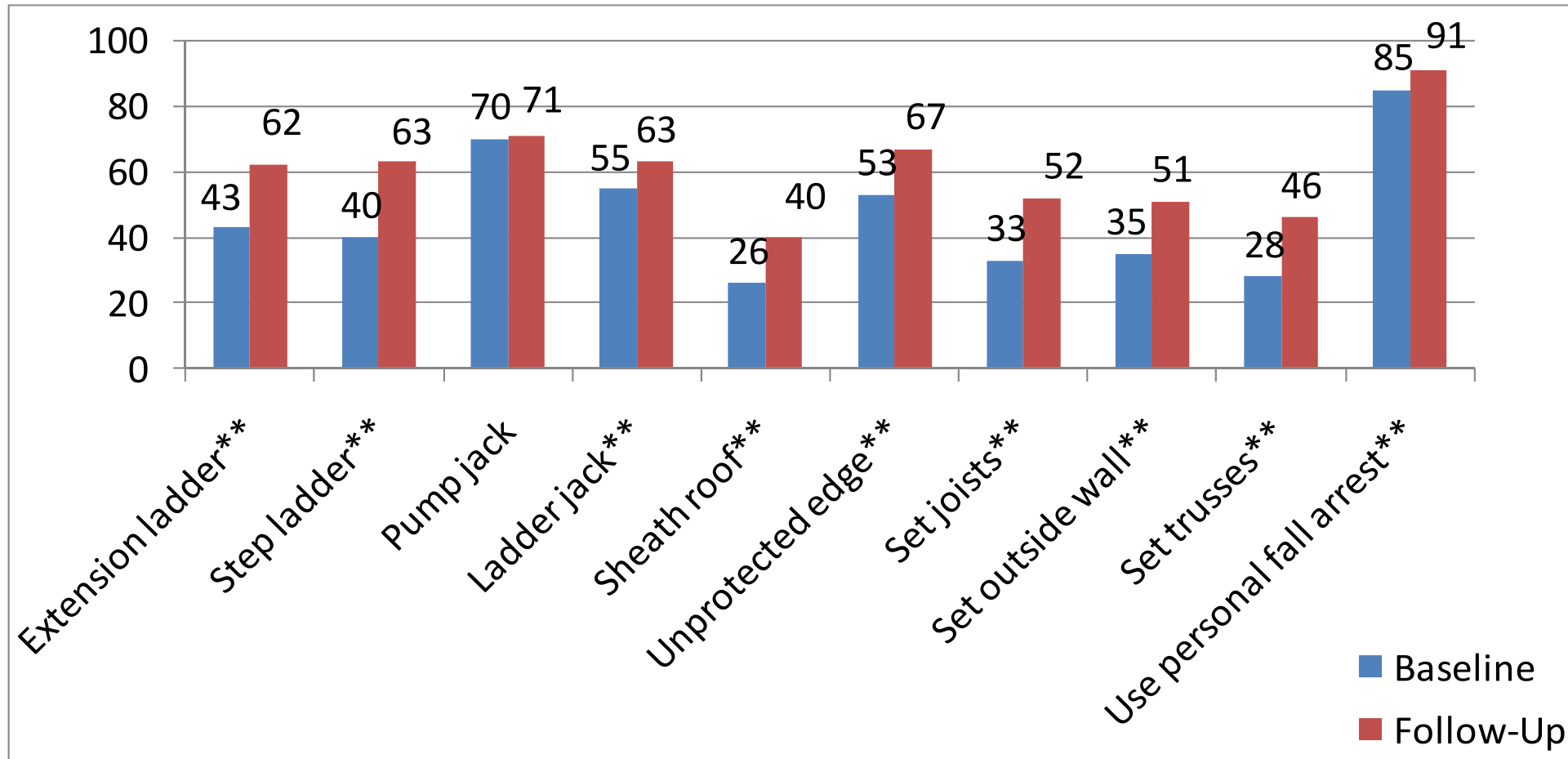


- ▶ Worksite Audits-933
- ▶ Questionnaires-200

Phase III
Evaluation of
Effectiveness

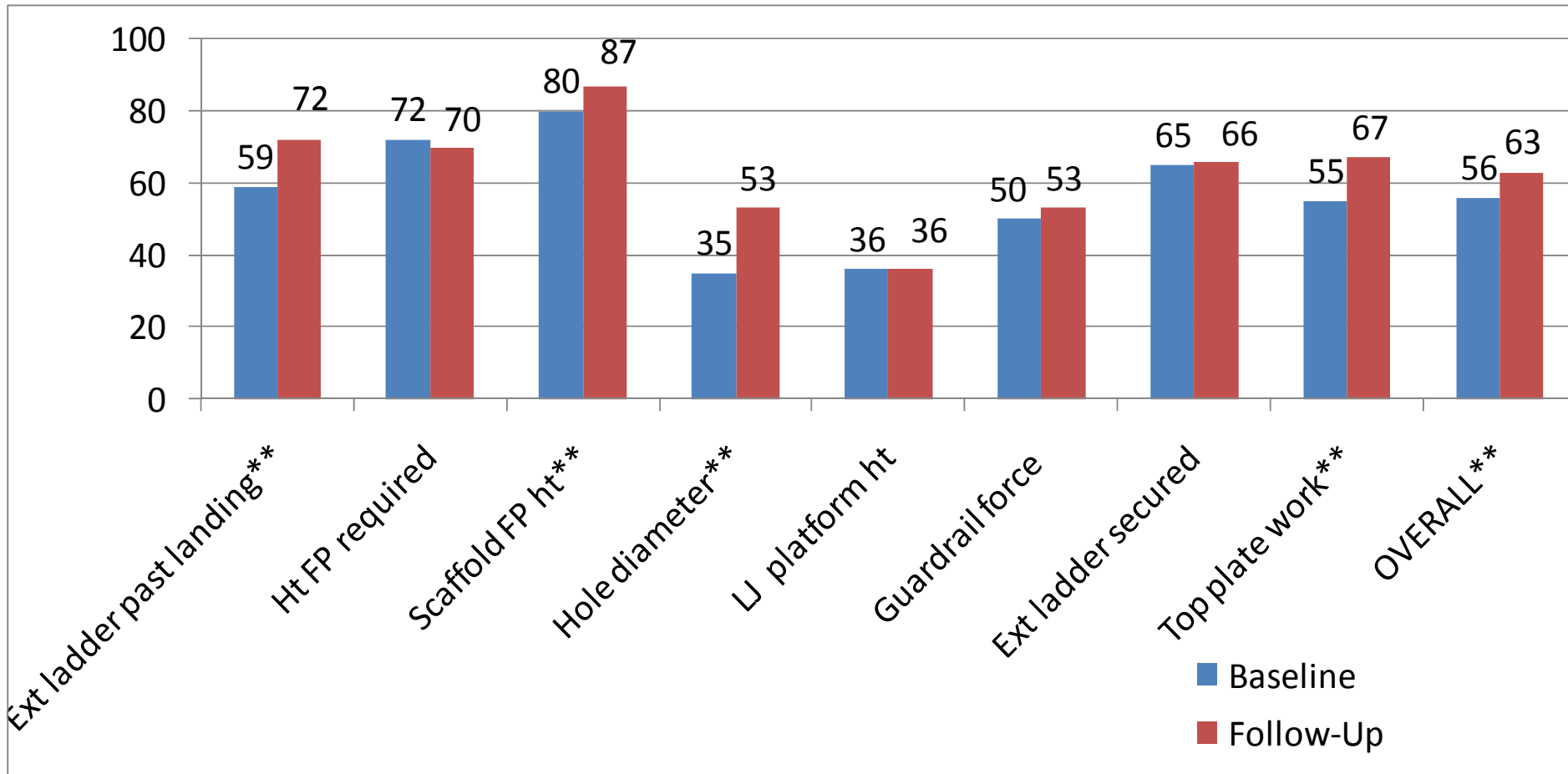


Percent Reporting Trained at CJAP Prior to Task Performance at Work



* $p \leq .05$, ** $p \leq .01$

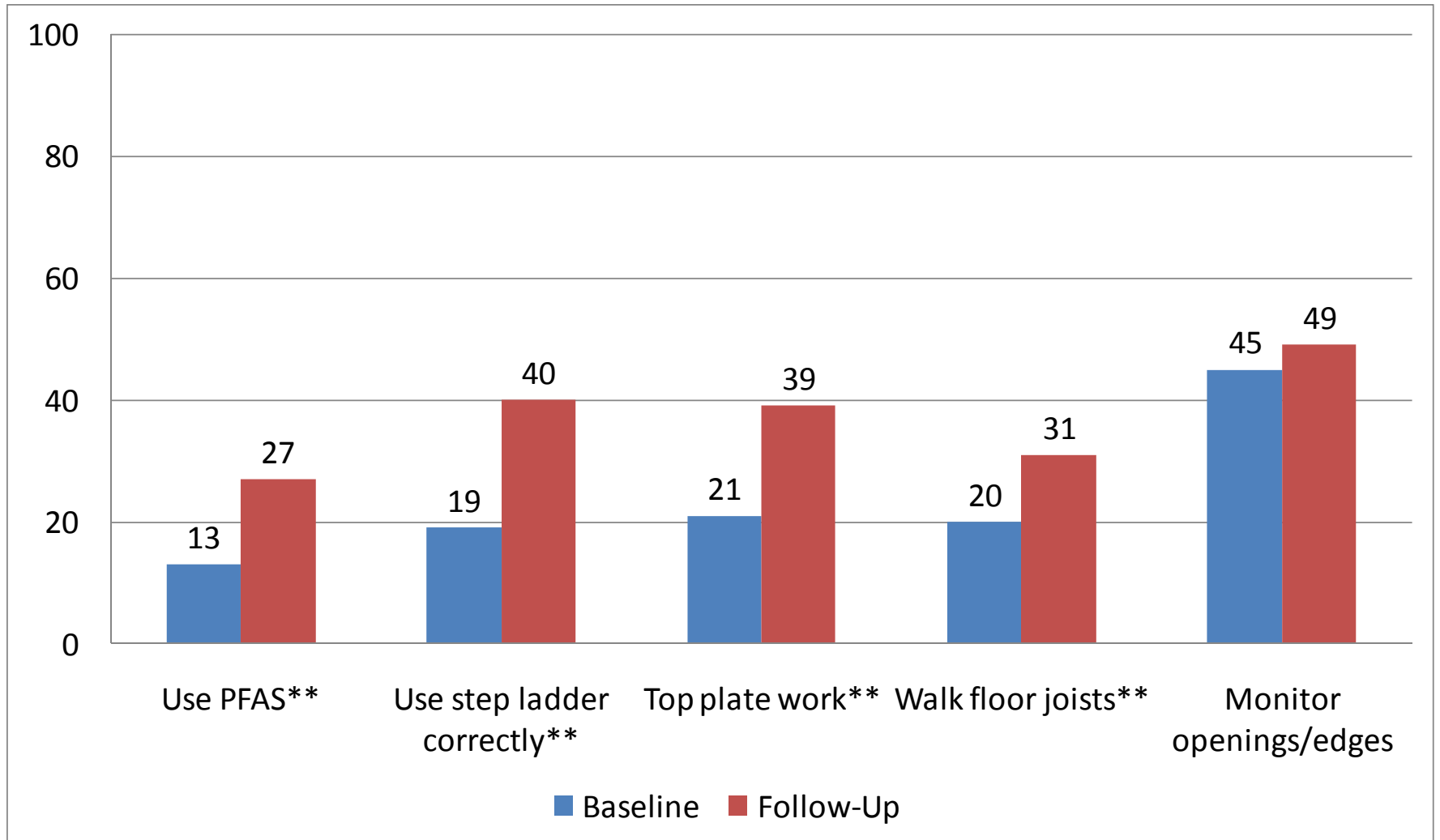
Percent Knowing OSHA Regulation



* $p \leq .05$, ** $p \leq .01$



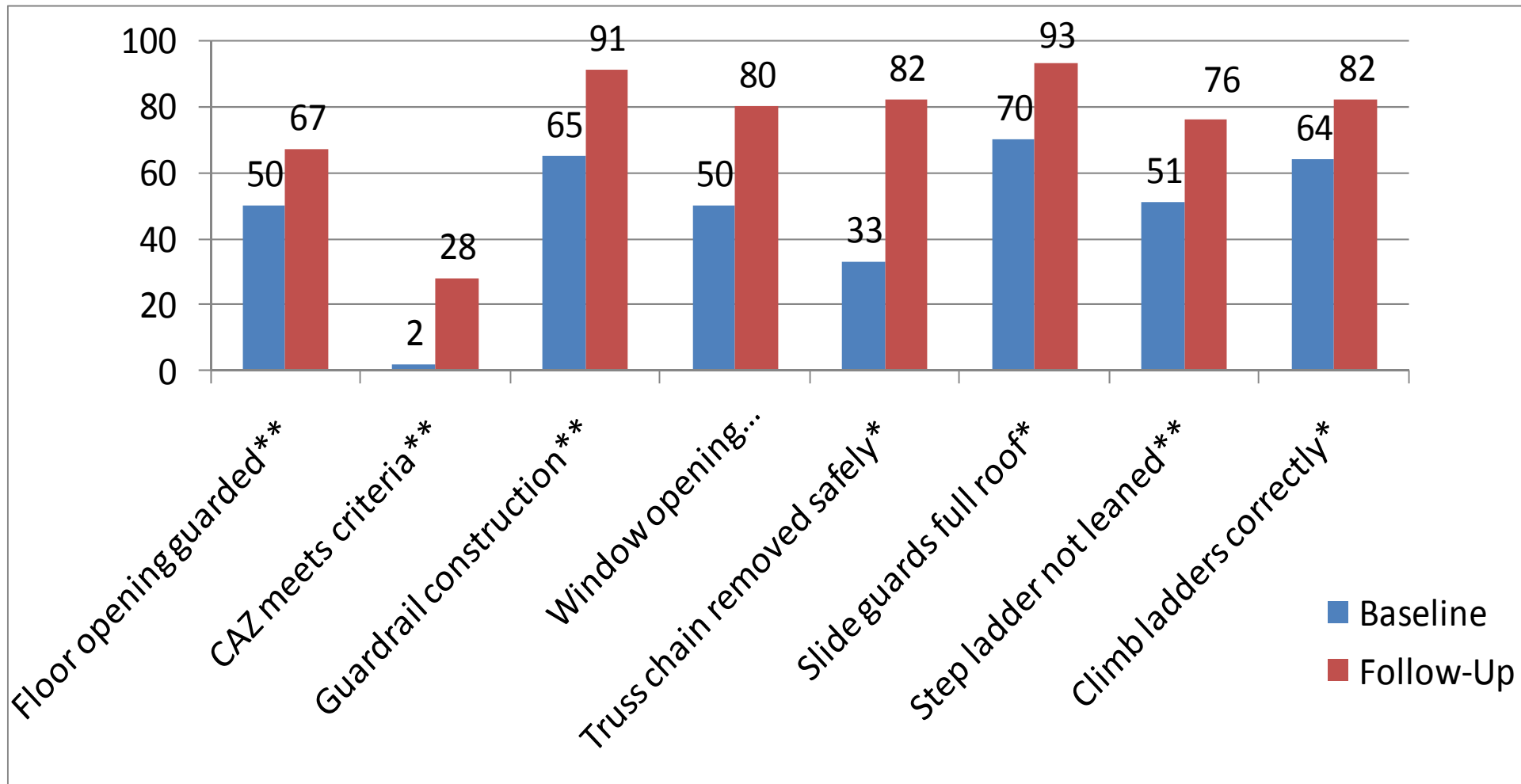
Percent Reporting Safe Crew Behavior



* $p \leq .05$, ** $p \leq .01$



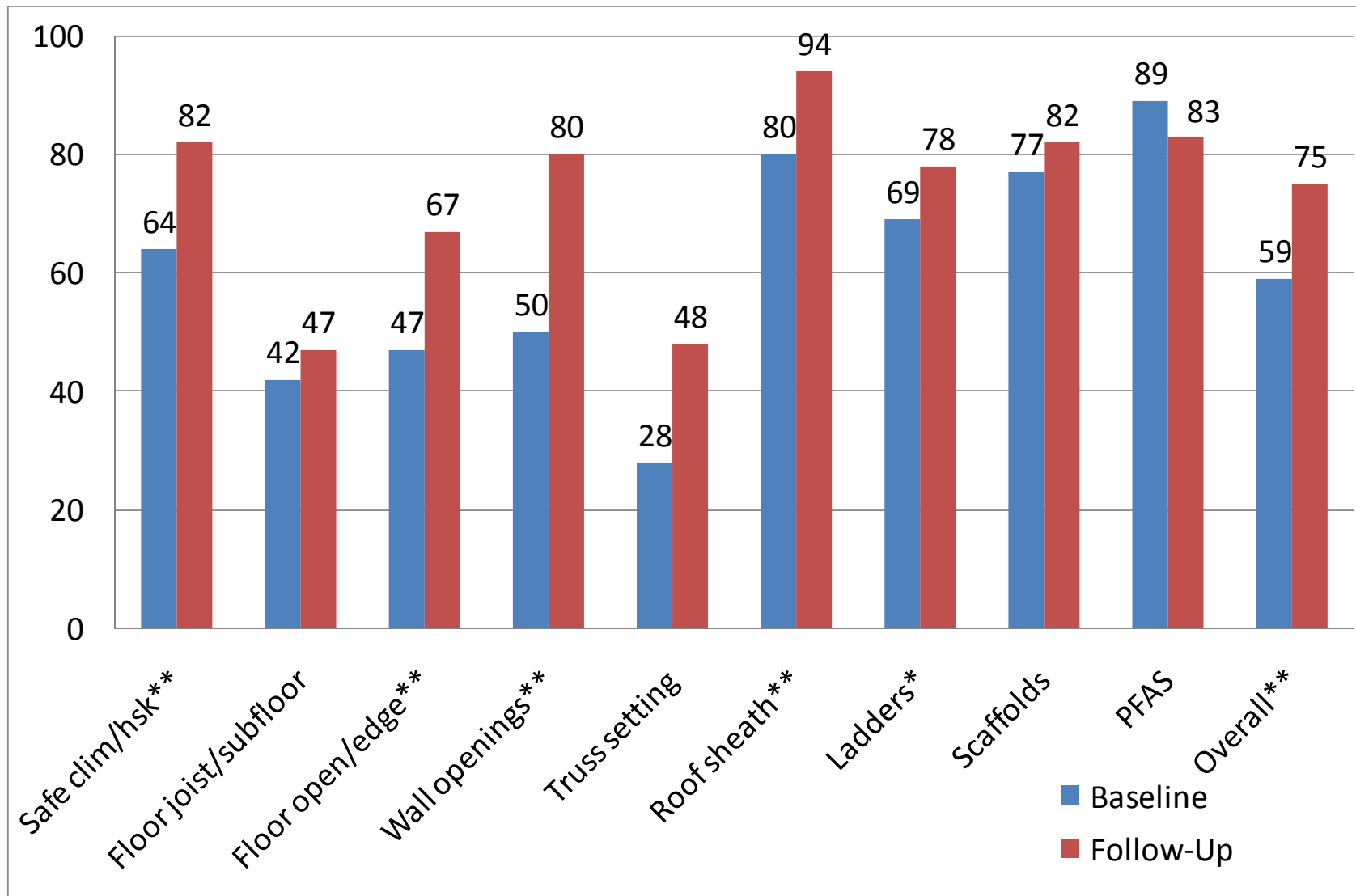
Percent of Time Audit Items met Safety Criteria



* $p \leq .05$, ** $p \leq .01$



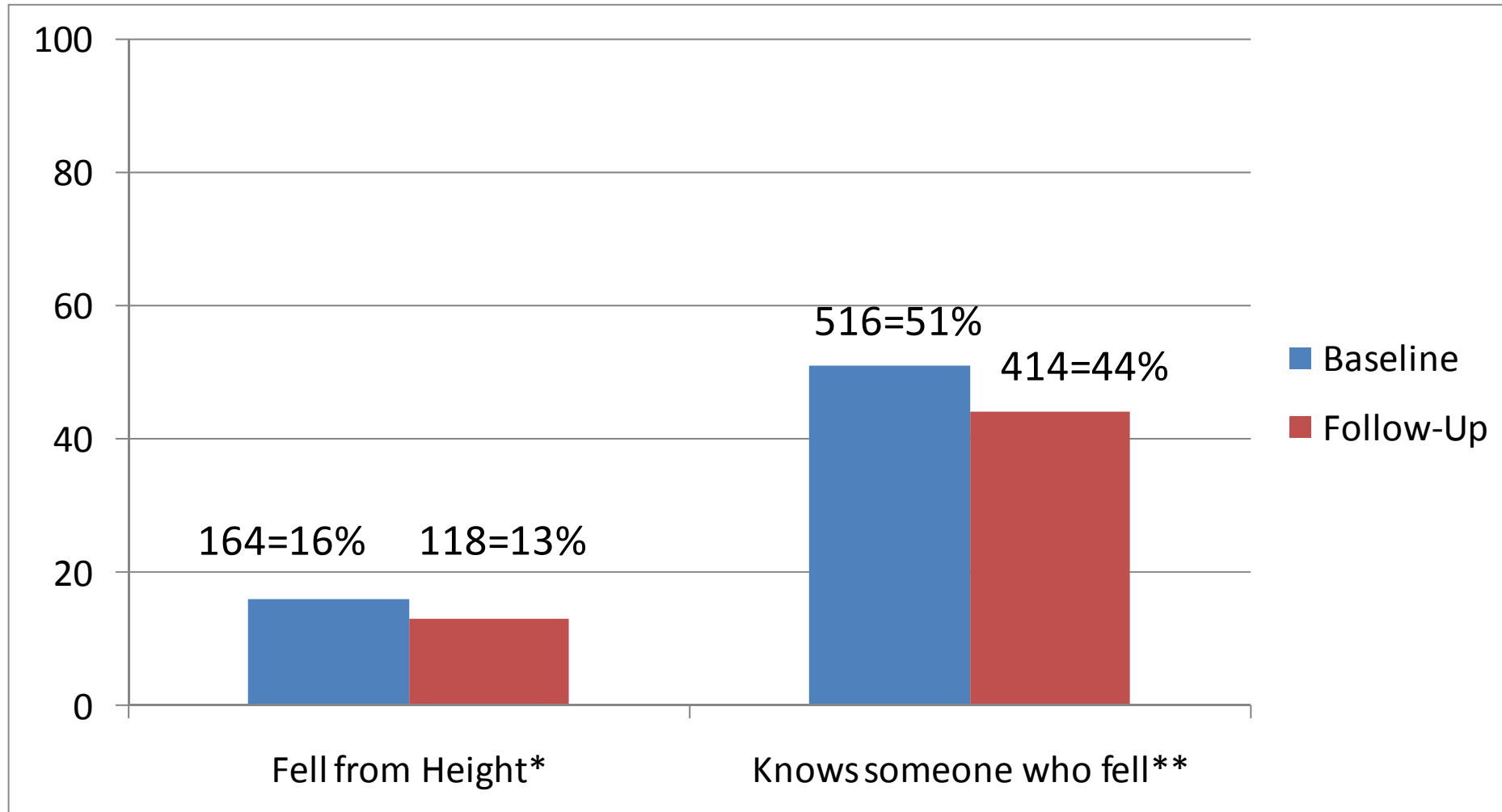
Percent of Time Audit Scales met Safety Criteria



* $p \leq .05$, ** $p \leq .01$



Percent Reporting Fall from Height



* $p \leq .05$, ** $p \leq .01$



Conclusions

- ▶ Falls from heights are common in construction
- ▶ Despite training & mentorship apprentice carpenters lack fall prevention knowledge
- ▶ Unsafe behaviors at heights are common
- ▶ Instructors can develop training to address knowledge gaps & change behaviors
- ▶ Training can result in improved safety when working at heights
- ▶ Using needs assessment to drive intervention was an effective method to drive training
- ▶ Methods can be replicated



What's next?

- ▶ Monitor long-term effects of curriculum
- ▶ Develop worksite based fall prevention training & foreman mentorship program to decrease falls
 - Use needs assessment to identify current state
 - Develop 1-day foremen training
 - Measure effects of training on fall behaviors
- ▶ Increase use of fall prevention technology
 - Measure current use of residential fall technology
 - Pilot fall prevention devices
 - Measure effects
- ▶ Disseminate our methods, tools, and results
 - SAFR on the eLCOSH website www.cdc.gov/elcosh/



Discussion

