A Systematic Review of the Safety Climate Intervention Literature: Past Trends and Future Directions

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Liberty Mutual 2020 Workplace Safety Index

Total cost of the most disabling workplace injuries: **$59.59 billion**

	Cost billions	Percent total	
1.	$13.98	23.5%	Overexertion involving outside sources (Handling objects)
2.	$10.84	18.2%	Falls on same level
3.	$6.12	10.3%	Struck by object or equipment (Being hit by objects)
4.	$5.71	9.6%	Falls to lower level
5.	$4.69	7.9%	Other exertions or bodily reactions
6.	$3.56	6.0%	Roadway incidents involving motorized land vehicle (Vehicle crashes)*
7.	$2.06	3.5%	Slip or trip without fall
8.	$2.05	3.4%	Repetitive motions involving microtasks
9.	$2.00	3.4%	Struck against object or equipment (Colliding with objects)
10.	$1.92	3.2%	Caught in or compressed by equipment or objects (Running equipment or machines)

* Typically involving a car or truck

https://viewpoint.libertymutualgroup.com/wp-content/uploads/2020/04/WSI_1000.pdf

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Beyond the Traditional Approaches

Risk Managers and Safety Directors are now exploring organizational and psychosocial factors in the workplace to complement other approaches in an attempt to make further improvements.

Safety Climate/Safety Culture investigations are a major part of this effort.

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Definition of Safety Climate

- First introduced by Dov Zohar (1980)
- Safety Climate (SC):
  - Employees' perceptions of the safety policies, procedures, and practices at a given point in time
  - Overall importance and "true" priority of safety at work

Definition of Safety Climate

The #1 Dimension

Managerial Commitment to Safety:

Prioritize safety over delivery & other competing demands across range of situations

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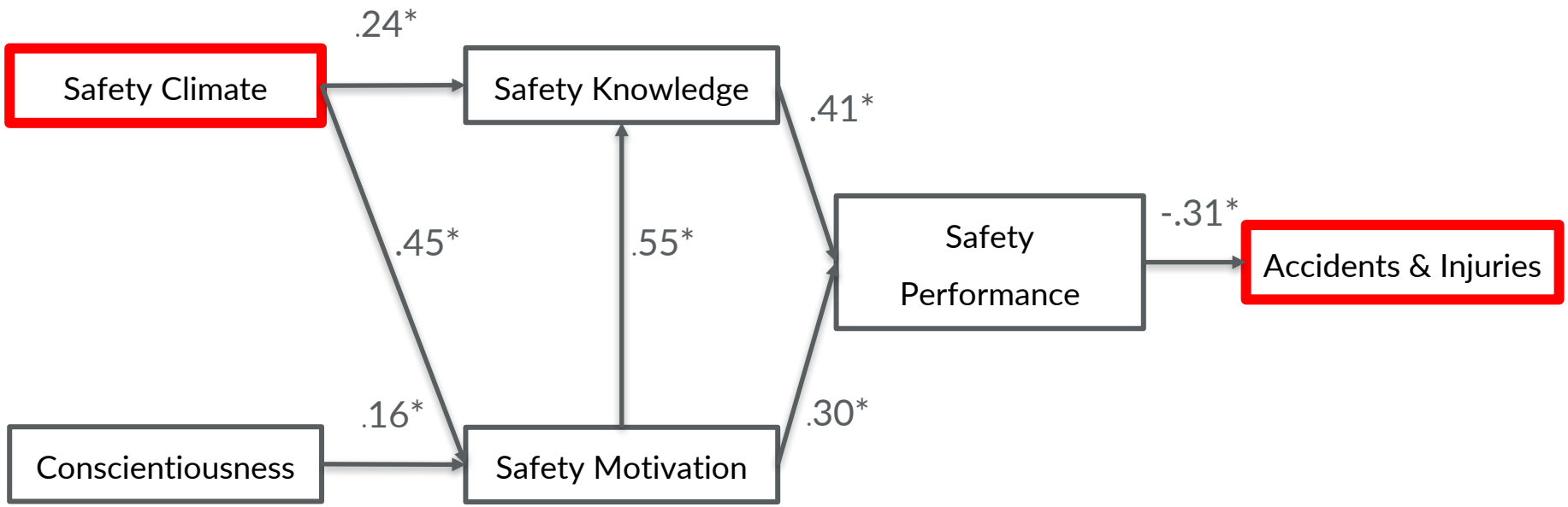
Meta-Analysis by Christian, et al. (2009)
Combined Results of 90 Studies

Safety Climate is a robust predictor of future injury



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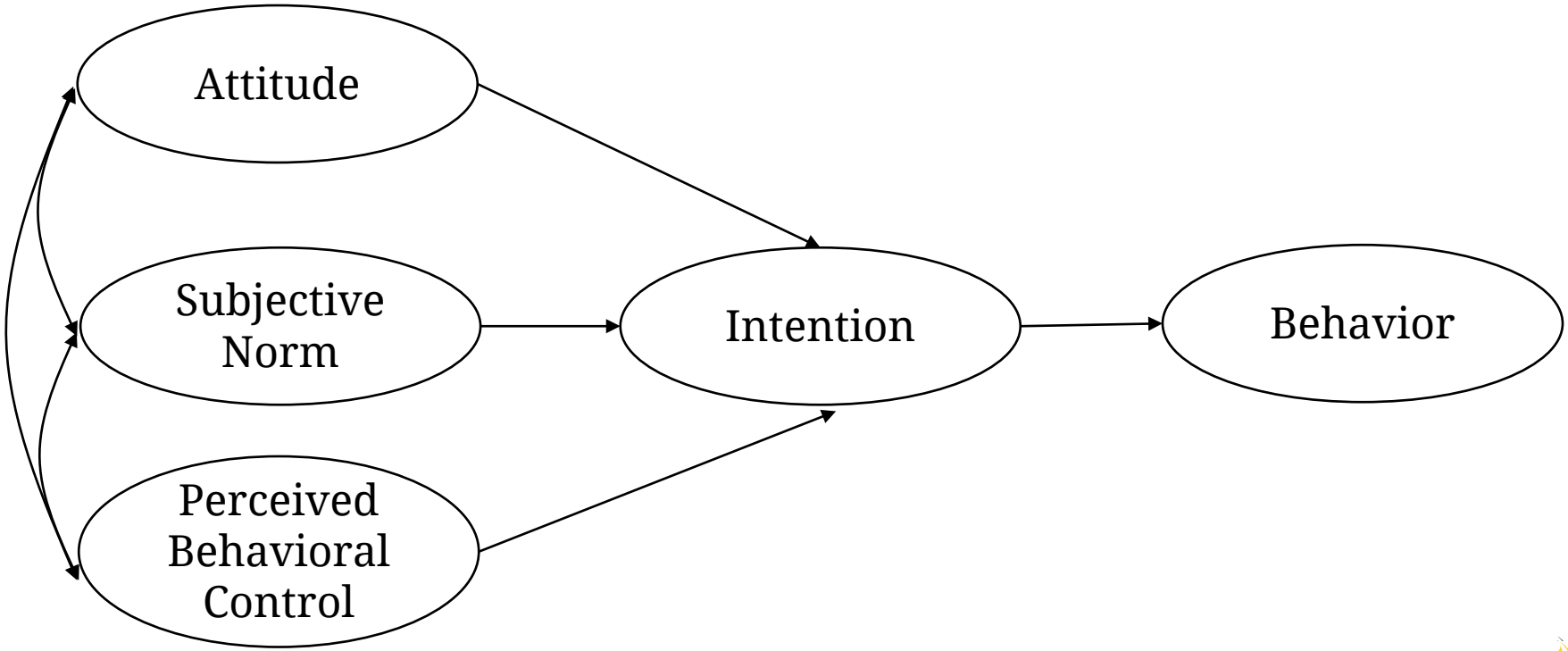
Psychological Theories:
the links between Safety Climate and outcomes

Theory of Planned Behavior (Ajzen, 1991)



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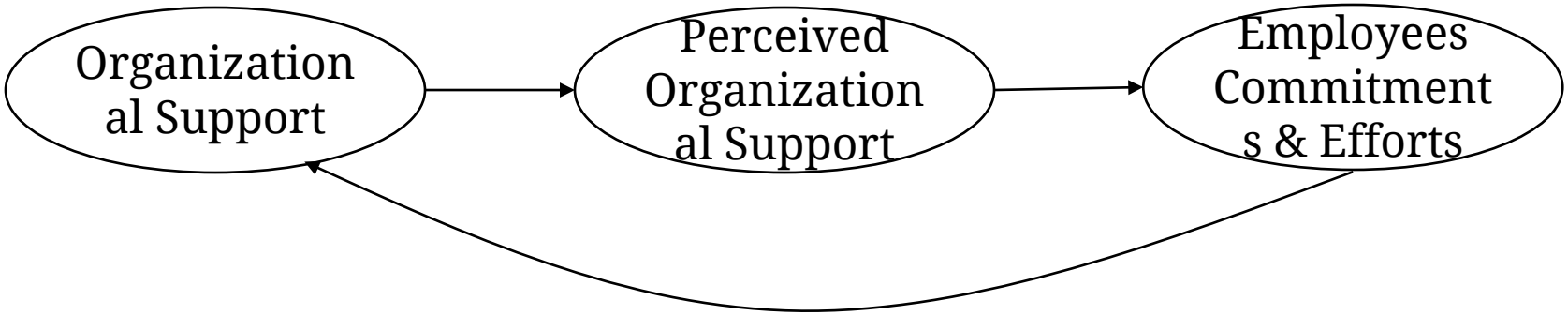
Psychological Theories:
the links between Safety Climate and outcomes

Social Exchange Theory (Cropanzano & Mitchell, 2005)



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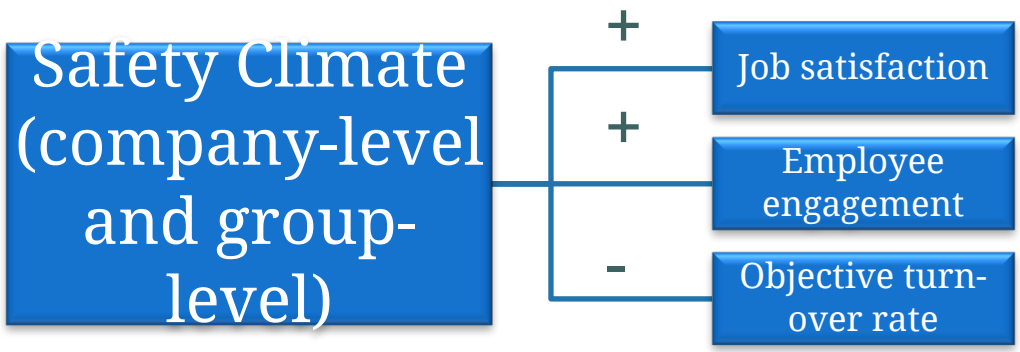
The Impact of Safety Climate Extends Beyond Safety Outcomes



Huang, et al.,
Applied Ergonomics, 2016

SC has significant impact on employees' job satisfaction, employee engagement and objective turnover rate.

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A Systematic Review of the Safety Climate Intervention Literature

- Lee, J., Huang, Y. H., Cheung, J. H., Chen, Z., & Shaw, W. S. (2019). A systematic review of the safety climate intervention literature: Past trends and future directions. *Journal of Occupational Health Psychology*, *24*(1), 66-91.
- https://psycnet.apa.org/doiLanding?doi=10.1037%2Focp0000113

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Safety Climate Intervention

- SC Intervention promotes Occupational Safety & Health (OSH) through SC
  - Enhanced SC may not be an ultimate goal but a byproduct of targeted efforts to improve work systems
- DeJoy et al. (2015)
  - All kinds of endeavors that promote the safety saliency could be viewed as SC interventions
  - Any efforts to promote safety behaviors & reduce accident, injury, & fatality rates can result in SC promotion

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Study Purposes

- Categorize & summarize the different types of efforts to improve SC in varying occupational contexts
  - SC interventions were those specifically intended to show a marked change in safety attitudes and norms across the organization
  - SC interventions were classified based on the work system components of the socio-technical systems framework (STS; Hendrick & Kleiner, 2002)

Study Purposes (continued)

- Synthesize empirical evidence on the effectiveness of interventions & strategies in advancing SC
  - Effectiveness was determined by a meaningful increase in SC scores after the implementation of the SC intervention compared to pre-intervention or control condition.

Taxonomy of 5 Subsystems of the Socio-Technical Systems Framework

1.External Environment	▪ Political / Legal (regulations) ▪ Cultural / Educational ▪ Technological / Economic ▪ Environmental / Market driven & competition
2. Organizational & Managerial Structure	▪ How the organization is designed - organizational hierarchy - managerial values
3. Technical Subsystems	▪ How work is performed - job design - hardware / software design
4. Personnel Subsystems	▪ Who performs the work - personnel - training (knowledge, skills & abilities)
5. Internal Environment	▪ Psychosocial & physical - work-related psychosocial factors - physical work environment

(Kleiner, 2008; Hendrick & Kleiner, 2002)

Review of SC Intervention Literature

- Characteristics of study sample & design
  - Sample: size, job types, ranks, & occupational contexts
  - Research design:
    - Design types (e.g., within-/between-subjects design),
    - Number of conditions
    - Time scheme (e.g., frequency & duration of intervention; interval between the study phases)

Review of SC Intervention Literature (continued)

- Intervention strategies
  - Key factors addressed by the intervention (e.g., communication, leadership, & physical environment)
  - Specific strategies & procedures of the intervention
  - Differences between control & intervention conditions or before & after the intervention
  - Interventions were categorized by 5 subsystems of Socio-Technical Systems (STS) framework

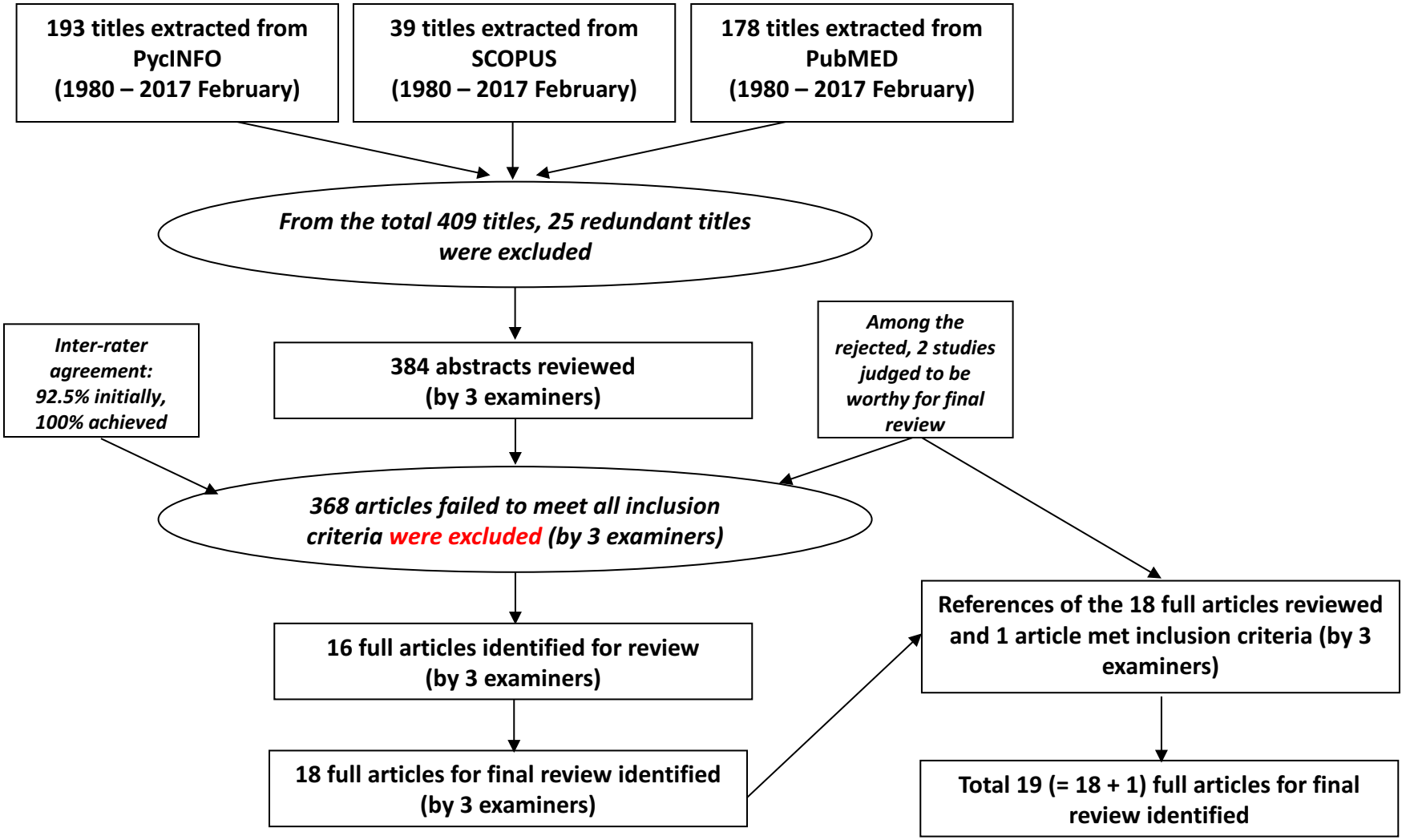
Review of SC Intervention Literature (continued)

- Intervention outcomes
  - Magnitude of change in SC scores (or observations) between control & intervention conditions or before & after the interventions
  - Where available, effect size statistics were noted to evaluate the effectiveness of the intervention
- Limitations
  - Study authors pointed out potential limitations & weaknesses in terms of the study design & safety climate intervention strategies

Inclusion & Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Keywords	▪ "Safety climate/culture" & "intervention"	
Research setting	▪ Various workplaces with more or less occupational safety & hazards	▪ Patient safety climate/culture
Research design	▪ Based on an experimental design - between/within subject design	
Intervention	▪ Offering specific administrative info - focus, target, time scheme	
Outcome variable	▪ SC or any of sub-dimensions - change score - before & after intervention - control vs. intervention group	▪ Only one time measure or qualitative observation of SC or any of sub-dimensions
Etc.	▪ Published in English ▪ Full text available	

Scientific Literature Search Procedure



Results

- 19 studies for final review
  - Very limited number of studies on the effectiveness of SC interventions
  - J. of Safety Research (26.3%), Safety Science (15.8%), J. of Applied Psychology (10.5%)
  - Zohar's (2002) study was the first in implementing a SC intervention & scientifically examining its effectiveness
  - Study sites: Denmark (31.6%) & USA (26.3%) / manufacturing, metal processing, food processing, construction, railroad service, etc.

Results (continued)

- Study design
  - 52.6%: Quasi-experimental pre- & post-intervention design
  - 42.1%: Mixed-design approach (both between- & within-subject design)
  - Olsen et al. (2009) adopted a pre-experimental design
  - Randomization considered in only 26.3%
- Intervention Duration
  - Ranged from 4 weeks (Haas, Cecala, & Hoebbel, 2016) to 3 years (Nielsen, Carstensen, & Rasmussen, 2006).

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Results (continued)

- All interventions in the 19 studies involved either OSH communication or education/training
  - 47.4% involved **improvement of safety leadership**
  - 26.3% involved **physical work environment improvement**
  - 21.1% incorporated **technological aspects of work** into SC interventions

Results (continued)

Safety Climate intervention activities	Frequency (%)
1. Set up and/or improve a health & safety organization committee	3 (15.8%)
2. Observe, inspect, & record occupational hazards & at-risk safety behavior	5 (26.3%)
3. Conduct collective brainstorming (among all levels of employees) to identify safety issues	5 (26.3%)
4. Conduct collective brainstorming (among all level of employees) for possible safety solutions	4 (20.1%)
5. Review & prioritize perceived problems & potential solutions	2 (10.6%)
6. Create opportunities for communication regarding safety through discussion & dialogue meetings	12 (63.2%)
7. Provide management with safety leadership training & development	9 (47.4%)
8. Provide supervisors with safety training & coaching sections	7 (36.8%)
9. Provide safety training to employees	8 (42.1%)
10. Use of technology, tools/equipment to monitor and/or improve safety	4 (20.1%)
11. Institute specific programs to improve physical work conditions	6 (31.6%)
12. Institute specific programs to minimize at-risk behaviors	5 (26.3%)
13. Set up system with metrics to track safety performance	3 (15.8%)
14. Collect feedback, evaluate progress, & set goals (individual & company) for improving safety	11 (57.9%)
15. Create working groups to address specific areas of safety concerns	1 (5.3%)
16. Incentivize & reward good safety behavior & outcomes	1 (5.3%)

Results (continued)

- STS mapping
  - All 19 interventions were categorized as focusing on improving ***organizational & managerial structure*** as well as ***personnel subsystem***
  - 26.3% aimed at improving ***internal (physical) work subsystem*** & 21.1% also aimed at improving ***technical subsystem***

Results (continued)

- 89.5% of studies showed a statistically significant improvement in SC (or its sub-dimensions)
- In some studies, statistically significant improvement in SC was found only in certain contexts
  - The supervisor action dimension of SC improved, but supervisor expectation dimension did not improve in Nielsen (2014)
  - Statistically significant increases in SC scores were found in one plant but not in another (Nielsen et al., 2006)

Results (continued)

- Limitations
  - Difficulty executing strictly controlled randomization of participants for applied field intervention studies
  - Inability to experimentally control uncertain external contexts (e.g., economic/market situation & socio-cultural aspects)
  - Engagement of organizational members in interventions (e.g., low response rate & attrition over the study duration)

Discussion

- Lack of study on the effectiveness of SC intervention (Zohar & Polachek, 2013)
  - SC is a multi-faceted & collective notion that is difficult to understand & assess in a simple and unified manner
  - Most SC research tends not to treat SC as a DV, but as an antecedent of safety behavior & objective safety outcomes (Griffin & Curcuruto, 2016; Zohar, 2010)

Discussion (continued)

- Primary emphasis of extant SC interventions is on organizational & managerial aspects of work
  - SC is an organizational construct based on OSH management & leadership
  - A broader range of intervention efforts can be considered focusing on "person-situation interactions" (Guastello, 1993)
- Future studies on potential antecedents of safety climate, other than known organizational & managerial factors, are required

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Discussion (continued)

- Systematic needs-assessment is needed for the design/implementation of SC interventions
  - For most reviewed studies, the process of SC intervention design was primarily initiated by researchers, not by workers

Discussion (continued)

- Better practices of SC assessment needed for testing the effectiveness of SC interventions
  - SC assessment of SC dimensions pertinent to the SC intervention program is critical
  - Timelines of SC assessment across different phases of intervention needs to be carefully thought out (Zohar & Polachek, 2014)

Discussion (continued)

- Recommendations
  - Inclusion of process measure(s) of SC intervention
  - Adoption of a multiple-baseline design which may enable observation of when the effectiveness of a SC intervention become remarkable
  - More than 2 follow-up measures over time because it may take a longer time to observe actual change in SC
  - Proper level of measurement; consideration of both SC level & strength

Questions?

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