2021 National Fire Service Research Agenda

Recommendations Report

January 2022

Sole Sponsor of the Research Agenda

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Cover Photo Courtesy of the Indianapolis Fire Department

National Volunteer Fire Council Chief Executive Officer Heather Schafer died suddenly on March 15, 2021. Heather was a friend and partner to the National Fallen Firefighters Foundation for nearly 30 years. She was an enthusiastic participant in conferences, symposia, and meetings, including the 4th National Fire Service Research Agenda. Her legacy of service to others continues to inspire those who were fortunate to work with her. We dedicate this report to Heather in honor of all she did to improve the fire service.

INTRODUCTION

The photograph on the cover of this report captures the 86th recruit class of the Indianapolis Fire Department taking their oath on February 22, 2021. The 59 recruits spent the next seven months working on their certifications for Firefighter I and II, Emergency Medical Technician, Hazardous Materials, and other training to prepare them for a career in the fire service. Ten of the recruits are legacy members with a relative serving or retired from the Indianapolis Fire Department.

When the recruits and their legacy family members discuss their experiences in the Indianapolis Fire Department, they likely find similarities in the camaraderie with their peers, a shared commitment to service, and the skills required to succeed in their roles. But as the recruits continue their careers, they will discover that the fire service is continually evolving. Advancements in science, data availability and use, research, and leadership training all contribute to the natural evolution of the fire service and its members.

We are at a challenging and exciting time in the history of the fire service. The fire service research conducted today is enhancing the ability of all fire service members (career, volunteer, wildland, industrial, etc.) to protect their communities while protecting their own health and safety. These two concepts, protecting others and protecting self, are not mutually exclusive, and in fact, they complement each other. Members of the fire service cannot deliver the highest quality protection to their communities without a holistic approach to research.

The goal of the 4th National Fire Service Research Agenda is to build on the fire service research conducted in the past with an eye to the future recruits like the 86th recruit class of the Indianapolis Fire Department. What will the fire department and fire service look like when their family members join 30 years from now? What traditions should remain? What progress should be made to improve the health and safety of firefighters? And perhaps most importantly, what will their role be?

Thank you to the Fire Safety Research Institute (FSRI) for sponsoring the 4th National Fire Service Research Agenda and for their ongoing fire service research support. Life-saving improvements in firefighter health and safety we know and enjoy today would not be possible without the dedicated efforts of the FSRI and the Assistance to Firefighters Grants Program. Thank you also to everyone who contributed to the 4th National Fire Service Research Agenda. Your commitment to firefighter health and safety further cements guidance to the research community on the needs of an ever-evolving fire service.

Troy Markel

Troy Markel
Chair, Board of Directors
National Fallen Firefighters Foundation

EXECUTIVE SUMMARY

The National Fallen Firefighters Foundation's Everyone Goes Home Program® is focused on improving the health and safety of firefighters. At the 2004 Firefighter Life Safety Summit (often referred to as the Tampa Summit), 16 Firefighter Life Safety Initiatives were created as the roadmap of the Everyone Goes Home® program. Firefighter Life Safety Initiative #7 states: Create a national research agenda and data collection system related to the 16 Firefighter Life Safety Initiatives. The goal of this initiative is to encourage continuous research into firefighter health and safety measures in the quest to minimize preventable firefighter line of duty deaths. Previous research agenda symposia took place in 2005, 2011, and 2015. Report outs from these symposia have generated research topics resulting in improvements in a wide range of fire service activities.

The 2021 National Fire Service Research Agenda Symposium was held virtually from February 15–March 8, 2021 to mitigate the risks associated with the COVID-19 pandemic. Symposium participants met virtually for two weeks to develop recommendations in three overarching domains. The domains and symposium structure were created by a planning team whose members are considered to be among the fire service's leading visionaries.

DOMAIN 1: Hiring/Retention/Advancement

Domain 1 focused on research related to recruitment, effective leadership, diversity/equity/inclusion/belonging, and hiring, promotion, and retention.

DOMAIN 2: Effective Operations

Domain 2 focused on research related to training, tactics, tools, equipment, apparatus, personal protective equipment, and community risk reduction.

DOMAIN 3: Health and Safety

Domain 3 focused on research related to wellness, understudied populations, cardiovascular health, cancer, mental health, metabolic health, reproductive health, occupational medical evaluations, fatigue, injury prevention/assessment, violence prevention/risk assessment, and work environment.

In each of the domains, it became apparent that the fire service could no longer segregate its work from other industries if it hoped to successfully research and understand complex and multidisciplinary problems. It is essential to collaborate with other disciplines to answer many of the pressing research topics identified in this research agenda. The list below identifies disciplines that may provide useful insight through partnerships with the fire service. This list is not all-inclusive but is provided to highlight disciplines with expertise that could benefit the fire service.

Anthropomorphics	Data Science	Higher Education
Architects	Economics	Imagining Technology
Biomechanics	Education	Information Technology
Business Administration	Engineering	Kinesiology
Construction	Ergonomics and Human Factors	Law
Chemistry	Epidemiology	Manufacturing
Communications	Forestry and Land Management	Marketing
Computer Science	Human Resources	Measurement Design

Medicine	Psychology	Sociology
Meteorology	Public Administration	Statistics
Military	Public Health	Technology
Organizational Psychology	Public Policy	
Political Science	Public Relations	

The recommendations for each domain are two-fold:

1. General recommendations from the jury of researchers and practitioners appointed by the Planning Committee; and

2. Recommended research questions developed by Work Group participants for each domain which were grouped into topic areas by the working group participants or during the preparation of this report.

Although the recommendations are specific to each domain, some of the recommendations could naturally fall under more than one domain. Researchers are encouraged to review the worksheets developed by the Work Groups found in Appendices C-E for detailed information on the scope of the recommendations.

Key Research Needs

- Research is needed on effective recruitment strategies to ensure adequate numbers of qualified personnel and improve/advance diversity, equity, inclusion, and belonging.

- Research is needed on the effectiveness of translating tactical research into training.

- Research is needed to understand the acute and chronic health risks associated with firefighting.

- Research is needed on how firefighter health and safety concerns are affected by type of work, structure of fire service, underlying health conditions, demographics, and other factors.

- The fire service continues to be most interested in risk mitigation research projects related to firefighter injury, fatality, occupational disease, or illness.

- Research is needed on the effectiveness of mitigation strategies to decrease risk and improve health or performance.

- Research is needed to identify the most effective communication strategies to use with potential recruits, new personnel, a diverse workforce, governing bodies, and the public.

Considerations For Successfully Conducting and Disseminating Fire Service Research

- Fire service research should expand to include research partners such as non-fire service organizations, community organizations, academic institutions, hospitals, and other industries like insurance and real estate.

- Multiple fields of research and approaches are needed, including, but not limited to, clinical, epidemiological, qualitative, quantitative, and translational.

- National organizations need to create a standard dissemination method for evidence-based guidance.

- An easily accessible "clearinghouse" for fire service research is needed for practitioners and potential future research projects.

The National Fallen Firefighters Foundation's Everyone Goes Home Program® is focused on improving the health and safety of firefighters. Visit www.everyonegoeshome.com to learn more about the 16 Firefighter Life Safety Initiatives, including #7, "Create a national research agenda and data collection system related to the 16 Firefighter Life Safety Initiatives."

RECOMMENDATIONS METHODOLOGY

STEP ONE: Planning Committee (October 2020–February 2021)

The Planning Committee included fire service researchers, fire service practitioners, and representatives from national fire service organizations. They were tasked with reviewing past symposia, determining the structure for the 2021 Research Agenda Symposium (RAS) and the process for the Work Groups. The Planning Committee identified three broad domains where research was needed to support the fire service: Hiring/Retention/Advancement, Effective Operations, and Health and Safety. These domains provided the overarching framework to organize the work of the participants in the RAS. The Planning Committee identified major topic areas within each domain (see table below), but the Work Groups were not limited to these topics.

The Planning Committee also asked the Work Groups to address six additional elements that affect all domains: data, technology, effectiveness measures, research types, research disciplines, and public policy/social science. These elements were included in the form of guiding questions on the worksheets used by the Work Groups to promote some degree of consistency for the jury reviewing the submissions:

- What data is needed?

- What technology is needed?

- Define what an "effective measure" would be for this domain/topic.

- What type of research is needed?

- What discipline(s) of research should be engaged?

- What public policy/social science inputs are needed?

Domains (Topics where research is needed)			
	Hiring/Retention/Advancement	**Effective Operations**	**Health and Safety**
Overarching Question	*How do we get people in, keep them, and help them grow?*	*How do we do the job effectively?*	*How do we take care of people and encourage them to take care of themselves?*
Topic Areas	Effective Leadership	Training	Health
	Diversity, Equity, Inclusion, and Belonging (DEIB)	Tactics	Wellness
	Recruitment	Tools, Equipment, Apparatus	Fitness
	Hiring	Personal Protective Equipment (PPE)	Medical Issues
	Retention	Community Risk Reduction (CRR)	Occupational Disease
	Advancement	Fire Station Design	Injury Prevention

Elements Affecting All Domains (Ways to conduct research)
Data:
Technology:
Effectiveness Measures:
Type of Research:
Disciplines of Research:
Public Policy/Social Science:

The completed worksheets from the three domains are included in Appendices C-E. Researchers are encouraged to reference the worksheets to gather feedback from the participants on the six components listed above.

The Planning Committee decided to implement a similar jury system as was used at the 2015 Research Agenda Symposium. Comprised of researchers and practitioners, the jury was tasked with reviewing the worksheets completed by the Work Groups (see Step Three) and providing feedback and recommendations for the three domains.

Lastly, the Planning Committee developed the invitation list for the Symposium. Attendees represented the interests of structural firefighting, wildland, aircraft rescue and firefighting (ARFF), emergency medical services (EMS), national fire service organizations, occupational healthcare providers, and researchers. In addition, invitations were extended to economists, sociologists, political scientists, city and regional planners, public policy experts, urban affairs specialists, epidemiologists, and public health representatives. Attendees completed a registration form to indicate their primary interests in the three domains. Attendees not assigned to a Work Group were able to participate as general attendees.

STEP TWO: Opening Session (February 15, 2021)

The Opening Session, open to Work Group participants and general attendees, began with remarks by Troy Markel (Chair, National Fallen Firefighters Foundation Board of Directors) and a welcome by Ron Siarnicki (Executive Director, National Fallen Firefighters Foundation). Dr. Steve Kerber (Executive Director, Fire Safety Research Institute) discussed the importance of research for firefighter health and safety and for the communities in which they serve. Dr. Sara Jahnke (Director and Senior Scientist, Center for Fire Rescue and EMS Health Research) discussed the need to establish close connections and collaborations between researchers and practitioners. Finally, Craig Haigh (Fire Chief, Hanover Park Fire Department) discussed the impact of research that had been translated to practice in the fire service.

Following the keynote addresses, Kevin Roche (Partner, Public Safety Resource Management) provided an overview of the Symposium. Adam Thiel (Fire Commissioner/OEM Director, Philadelphia Fire Department) presented the summary of previous research agenda symposia from 2004, 2011, and 2015. Roche closed the Opening Session by providing the Work Group instructions.

General attendees were encouraged to submit comments on their concerns for fire service research via a chat feature provided as part of the virtual platform. The video for the opening session is available on firehero.org.

STEP THREE: Facilitated Domain Work Group Sessions (February 16–25, 2021)

The Domain Work Groups met virtually over the course of two weeks. Each Work Group was comprised of no more than 30 attendees, and an established fire service researcher and a fire service practitioner served as facilitators. A scribe was assigned to each Work Group to capture the recommendations and work with the facilitators to complete the worksheets for the research topics. Jury members were prohibited from monitoring the Work Group sessions to maintain neutrality leading up to the closing session report outs and deliberations.

STEP FOUR: Closing Session (March 8, 2021)

The Closing Session was attended by the jury, Work Group participants, and general attendees. Facilitators presented a summary of their recommendations, and the jury was able to question the presenters. In addition, all attendees had the opportunity to provide comments and ask for clarification as needed. The final presentations are available on firehero.org.

STEP FIVE: Jury Deliberations (March 9–10, 2021)

The jury reviewed the worksheets provided by the three domains, the facilitators' final presentations, and the recommendations. The jury developed key comments regarding each domain, which appear at the beginning of each domain's recommendations. The jury was given the opportunity to conduct a final review of the recommendations before the publication of this report.

The final recommendations in this report are listed in numerical order but unlike previous research agenda reports, they are not prioritized or ranked in order of importance to encourage creative exploration of the widest possible range of topics to improve firefighter health and safety.

RECOMMENDATIONS

DOMAIN 1: Hiring/Retention/Advancement

General Recommendations from the Jury Deliberations

- Research should be conducted to evaluate model programs from fire departments and organizations focused on hiring, retention, and promotion. Researchers should take into consideration model programs for varied sized and type of fire departments.

- Effective performance metrics related to these topics need to be scaled to account for differences in department demographics (e.g., career vs. volunteer, urban vs. rural).

- Research can help support communicating best practices for implementing new processes and leading change.

- Traditionally, fire service leadership has referred to the chief officers of fire service organizations. There is a need to research the influence of informal leaders and emerging leaders and how these leadership groups can work together for stronger, more resilient organizations.

- Challenges/barriers faced by women, racial/ethnic groups, and the LGBTQI community in terms of recruitment, hiring, training and work assignments should be investigated.

- Hiring practices should be examined to assess if they support or suppress diversity/equity/inclusion/belonging (DEIB).

- Appendix F provides a list of fire service-related organizations which may be a useful resource for researchers seeking to better understand the fire service.

Reminder: The research topics are not listed in order of priority.

TOPIC 1: *Effective Leadership*

Focus 1	Effective Leadership (General)
#1	What are performance metrics for determining effective leadership? Are they dependent on the organization's demographics?
#2	What are the required levels of expertise and identifiable skill sets for leadership, considering department and community demographics?
#3	What are the differences between leadership and managerial characteristics? Do followers respond better to leadership or managerial characteristics?

Focus 2	Training
#4	What performance metrics should be used to measure success in training and developing leaders beyond core competencies? For example, it may be beneficial to evaluate personality, attitude, values, communication skills, organizational understanding, etc.
#5	Aside from traditional fire service tasks, what other skills are essential for today's firefighters? Consider skills related to social/emotional interactions, conflict management, personnel management, and leadership skills.
#6	What is the efficacy of training processes for leadership development based on rank and role?
#7	How can formal and informal training processes can be used most effectively?

Focus 3	Developing Effective Leadership Skills
#8	What are the best approaches to develop effective leaders for career and volunteer fire service members? How can this be measured quantitatively and qualitatively?
#9	What leadership development skills need to be developed for the fire service?
#10	What can be learned by studying why leaders choose to leave their position or organization?
#11	What are the needs of fire department professional development and officer training programs?

Focus 4	Defining Effective Leadership and Management Skills
#12	What operational and interpersonal skills can be identified in effective leaders?
#13	What are the preconceived perceptions of leaders and their followers?
#14	What are the generational differences in expectations of effective leaders?
#15	How does effective leadership relate to moral and motivational climate?

Focus 5	Motivation for Leadership
#16	Why do people choose to be leaders in the fire service?
#17	What are the differences in motivation generationally, gender, and race/ethnicity?
#18	What organizational and individual barriers exist for potential leaders, and how can those barriers be approached?

Focus 6	Diversity/Equity/Inclusion/Belonging (DEIB) and Effective Leadership
#19	What do leaders need to know to promote an inclusive organization?
#20	How can the concept of emotional intelligence be a key promoter of DEIB efforts for fire service leaders?

Focus 7	Best Practices
#21	What are the current and emerging best practices in effective leadership and management development training and methods?
#22	What innovative training methods (e.g., role-playing scenarios, peer feedback, etc.) can be used for leadership training?
#23	What are the best practices in identifying and engaging leaders in other industries, including international fire service organizations?

Focus 8	Informal Leaders
#24	How can an organization identify the informal leaders to work in conjunction with the formal leaders?
#25	What training and skills can an organization provide to informal leaders?

TOPIC 2: *Diversity, Equity, Inclusion, and Belonging (DEIB)*

Focus 1	Consistent Metrics
#26	What are the common set of metrics for the fire service to allow for comparisons across and between populations?
#27	What metrics should be designed within a framework that is easily usable and implementable by fire organizations?
#28	What benchmarks can be used to compare the fire service with other occupational groups?

Focus 2	Organizational Bias
#29	What is the presence, impact, and assessment of organizational bias?
#30	How does an organization identify, address, and propose actions to eliminate organizational bias, and how can these actions assist fire organizations in identifying needed improvements to policies and procedures?

Focus 3	Implicit Bias
#31	How can an organization identify and address implicit bias as needed?
#32	What are best practices surrounding DEIB issues, such as effective messaging, using terminology to support DEIB efforts, and addressing personnel who may have an implicit bias?

Focus 4	Benefits of Diversity
#33	What are the benefits of diversity in the fire service?
#34	What are the measurable outcomes of efforts to promote diversity? These may include job satisfaction, behavioral health implications, stigma reduction, community expectations, service delivery, productivity, and job efficiency.

Focus 5	Creating a Diverse Fire Service
#35	What are the effective recruitment methods and strategies that can expand diversity within the fire service?
#36	How can the fire service apply lessons learned from efforts to reduce the stigma around behavioral health issues to issues related to diversity?
#37	What is the impact of consent decrees on DEIB?
#38	Can task analysis research identify the types of candidates best fitting for the fire service sensitivity to sub-sections of the fire service?
#39	What aspects of successful models from other industries can be applied to the fire service?

Focus 6	Cultivating a Culture of Inclusion
#40	How can the fire service and departments promote a culture of inclusion?
#41	What is the measurable impact of the culture of inclusion related to personnel experience and department outcomes?
#42	What is the role of white male propensity to embrace DEIB, and what are the effects of white male buy-in on DEIB constructs?
#43	What is the effectiveness of promoting DEIB allies, the impact of intervention efforts, and successful mechanisms for inclusion?

Focus 7	Roles of Mentors, Sponsorships, Advocates, Champions, and Coaching
#44	How can mentors and other supportive relationships be leveraged to promote DEIB?
#45	How can a fire department enhance formal and informal supporting relationships to promote DEIB?

Focus 8	Role of Inclusiveness
#46	What is the role and value of inclusiveness, and what is the impact when inclusiveness is limited or missing?
#47	What are the perceptions of inclusiveness and belonging within the fire service?
#48	What are the stages of building an inclusive organization?
#49	What are strategies to overcome inclusion challenges?

Focus 9	Cost of DEIB
#50	What is the financial impact of a lack of diversity and inclusion in an organization?
#51	What is the financial impact of having a diverse and inclusive organization?
#52	What are the impacts on an organization's personnel (e.g., behavioral health, productivity, belongingness, job satisfaction), organization (e.g., equity in service delivery, community satisfaction), and culture related to DEIB efforts?

Focus 10	Training on DEIB
#53	What are the baseline educational needs and concepts necessary to effectively promote DEIB in the fire service?
#54	How can DEIB concepts be integrated into training, how do they relate to measurable performance benchmarks, and how can the benchmarks be operationalized?
#55	How can DEIB best approaches be included in leadership training, company officer training, and recruit school?

Focus 11	Leading and Emerging Practices
#56	What emerging practices are most effective related to promoting DEIB?
#57	How can best practices from other occupational groups be applied to the fire service?

Focus 12	Barriers to DEIB
#58	What barriers exist to DEIB within different department demographics (e.g., type of department, size of department, etc.), and how can these challenges be approached?
#59	What effective methods, messaging, and training models can be used within the fire service to promote DEIB efforts?

TOPIC 3: *Recruitment*

Focus 1	Recruitment Methods
#60	What are the methods for recruiting career and volunteer firefighters? For example, where and how are firefighters being recruited successfully, how are recruits learning about the fire service, and what messages are most effective for engaging recruits?
#61	What are the benefits of investing in recruitment efforts to achieve the most robust applicant pool?
#62	How can the fire service better understand the personality traits of successful firefighters to target recruitment efforts to those who are most likely to engage in the career and volunteer fire service?
#63	How can the fire service better leverage recruiting from within the fire service, including multi-generational fire department members?
#64	How can the fire service support the transition between the roles of a volunteer and career firefighter?
#65	What unified metrics and operational definitions can be applied to recruitment activities to allow for comparison between groups, benchmarking, goal setting, and measurements of success?

Focus 2	Barriers to Recruitment
#66	What are the barriers to recruitment across a broad spectrum of departments, regions, and communities?
#67	What preconceived perspectives and expectations do potential recruits face that may limit their interest in joining the fire service?
#68	Are there requirements in place that limit recruitment?
#69	What can be learned from those who enter and/or train but do not complete the process to become a firefighter?
#70	What can be learned from other occupations or volunteer opportunities and applied to the fire service?

Focus 3	Effective Recruitment Messaging
#71	What is the effectiveness of messages to the community about what it is like to serve as a career or volunteer firefighter?
#72	How can the perspectives of potential recruits be applied to constructing recruitment messaging that effectively attracts a diverse candidate pool?
#73	Specific to volunteer fire departments, what are the potential perceptions of recruits about the different tasks available within a volunteer fire department?

Focus 4	Community Perceptions
#74	What are the community's perceptions, expectations, and knowledge about the fire department and how it operates (both career and volunteer departments)?
#75	What are the best practices and monitoring metrics for engaging and educating the community?
#76	How can a department and/or a community better understand how sub-populations view the fire department to better assist with building a more vital recruitment strategy?
#77	What can be learned from examining volunteer recruitment in communities for non-fire service organizations?

Focus 5	Recruiting for the Future
#78	What are the essential skills and capabilities firefighters will need in the future, and what recruitment environment will be necessary for sustainability?
#79	How does the fire service welcome or not welcome a wider variety of individuals as potential recruits?

Focus 6	Models of Success for Recruitment
#80	What are innovative models of recruitment and best practices for recruiting that have been successful nationally? What are their efficacy and effectiveness?
#81	How can effective messaging, particularly building diversity among non-traditional groups, be used in career and volunteer departments?

Focus 7	Community Evaluation
#82	What considerations should a community examine to determine the appropriate department type for their fire service protection?
#83	What is the effectiveness of different approaches, including a cost-benefit analysis, to allow a community to make informed decisions about the type of fire service protection?

Focus 8	Promoting Diversity in Recruitment
#84	What effective methods are used or could be used to recruit a variety of experiences, backgrounds, and perspectives more widely?
#85	What is the impact of diversity in the fire service on the communities they serve?

TOPIC 4: *Hiring*

Focus 1	Hiring Tests
#86	What can be learned from a review of existing hiring exams? What are the limitations to the current methods (e.g., relationship to job tasks) and outputs (e.g., lack of diversity)?
#87	What is the relationship between the predictive skills and variables (e.g., critical thinking, communication, etc.) to the competencies needed as a firefighter?

Focus 2	Hiring Approach
#88	How can research support a fair and equitable hiring process that accurately measures competencies?
#89	What is the impact of preferential hiring, and what are the ways to leverage the hiring process to promote diversity?
#90	How do generational differences impact hiring processes?
#91	What prerequisites for hiring impacted by DEIB need evaluation for relevance to a fire fighter's job performance?

Focus 3	Leading and Emerging Practices
#92	What are the successful hiring processes and testing that promote diversity and a selection of strong candidates?
#93	What are the best practices for educating potential candidates early in their career search about requirements and qualifications?

Focus 4	Organizational Environment/Needs
#94	How does the organizational environment promote or limit inclusion?
#95	Particularly in the volunteer fire service, how does allowing an individual to join the department in a non-operational role promote inclusion?

Focus 5	Barriers to Effective Hiring
#96	Are there structural and functional barriers to hiring more diverse candidates?
#97	Are there formal barriers (e.g., rules and requirements) and informal barriers (e.g., traditions and perceptions) to hiring more diverse candidates?

Focus 6	Metrics for Hiring
#98	What are the metrics for assessing hiring processes as needed to accurately monitor a changing environment?
#99	Are there tools or strategies to identify when strong candidates may not continue with the hiring process?

TOPIC 5: Retention

Focus 1	Cost-Benefit Analysis of Retention
#100	Using behavioral economic research, what is the cost benefit of retention (or lack thereof)?
#101	What is the overall financial impact of retention on the department and community?
#102	How does the role of adequate funding impact retention efforts? For example, are underfunded departments less likely to retain firefighters?

Focus 2	Measurement Resources
#103	What are the standard metrics, definitions, and measurement tools that should be used in retention efforts?
#104	How can a department and the fire service better monitor retention focusing on subgroups (e.g., race/ethnicity, gender, tenure as a firefighter)?

Focus 3	Barriers and Facilitators to Retention
#105	What are the barriers to retaining firefighters in career and volunteer fire departments? Special consideration should be given to the type of department and other demographics.
#106	How do organizational factors (e.g., benefits, schedules, funding) and individual factors (e.g., camaraderie, sense of duty, skill expectations, other jobs) impact retention?

Focus 4	Role of Training in Retention
#107	What, if any, is the relationship between investments in training and retention rates?

Focus 5	Retention and Inclusiveness
#108	What, if any, is the relationship between inclusiveness and retention? Inclusiveness in this recommendation is used broadly to include the environment for firefighters.
#109	How do fire department relationships (e.g., humor, mealtime interaction, crew cohesiveness) impact retention?

Focus 6	Mentorship and Retention
#110	What, if any, role does mentorship (formal and informal) play in retention efforts?
#111	How does an individual or institutional bias play into the mentorship relationship?
#112	How does mentorship impact performance appraisals?

TOPIC 6: Advancement

Focus 1	Measuring Progress
#113	What reliable and valid tools can measure skill improvement across time, and what predictive tools can identify strong promotional candidates?
#114	What are the measures of competencies at different stages in the promotional process?

Focus 2	Promotional Exams, Qualifications, and Competencies
#115	How can promotional exams adequately assess a diverse range of skills and competencies?
#116	What is the best method to validate testing processes that are legally defensible, reliable, and valid while minimizing bias?
#117	What are the minimum qualifications and competencies across various domains (e.g., operational knowledge, interpersonal skills) necessary for leadership positions specific to the type of position and department structure?

Focus 3	Best Practices
#118	Using mixed methods research, what characteristics help identify what a "good leader" is?
#119	Can best practices be created by reviewing current promotional exams and assessment processes?
#120	What are the best practices for succession planning?

Focus 4	Barriers to Promotion
#121	What are the barriers to promotion for women and non-white male candidates, and how can the barriers be addressed?
#122	What are the barriers for presumed strong candidates who choose not to engage in the process, and how can the barriers be addressed?
#123	What are the barriers to embrace an inclusive environment supporting and encouraging promotion for diverse candidates, and how can the barriers be addressed?

Focus 5	Financial Implications
#124	What are the costs and benefits of different promotional processes?
#125	What can be learned from a cost analysis focused on the individual and organizational financial implications?

DOMAIN 2: Effective Operations

General Recommendations from the Jury Deliberations

- There should be an emphasis on outcomes as related to job performance requirements.

- A comparison of effective fire suppression operations to the emergency medical field as it relates to requirements could be beneficial.

- Research is needed on the effectiveness of translating tactical research into training. (Tactical refers to firefighting and other areas of response such as emergency medical response, public health issues, disasters, etc.)

- A recognition primed decision-making model related to effective operations may be valuable to research.

- There is a need for research on the effectiveness of each part of the firefighters' and first responders' Personal Protective Equipment (PPE). This research would include everything from a cost-benefit analysis to the effectiveness of a helmet's color.

- The safety behavior of personnel wearing PPE is paramount to understanding how policies and enforcement of the equipment can work together.

- Technology research should have a practical application to the broadest possible range of fire departments.

- Research is needed for broader programs involving public health and safety topics such as community paramedicine, informal settlements in the community, affordability of fire protection, and modified structures and facilities to accommodate the community's needs.

- Research should be conducted in conjunction with the National Fire Protection Association's 'Fire Loss in the United States' annual report and data published by the United States Fire Administration to show common community risk reduction elements such as the building codes, the fire protection standards, the enforcement of testing and maintenance, etc.

Reminder: The research topics are not listed in order of priority.

TOPIC 1: *Training*

Focus 1	Training Standards and Training Outcomes on the Fireground
#126	What is the relationship between the number of training hours accumulated and effectively performing duties as a firefighter?
#127	How do we develop firefighters' understanding and proficiency to make decisions in the fire environment efficiently?
#128	What elements of training make a difference on the fireground?
#129	What is a consistent way to measure training transfer and competency?
#130	How do the number of hours required by each state impact effectiveness?
#131	What is the effectiveness of crew-based training, training people specifically for what you want them to do?
#132	What is the relationship between training effectiveness and firefighter safety?
#133	How can a rubric be used to assess operations and training with objective measures of success and failure?

Focus 2	Certification, Standards, and Accreditation
#134	How many first responders are not certified?
#135	What would a national standard of certification look like?
#136	How can the fire service share effective training information with other states and other departments?

Focus 3	Live and Virtual Training
#137	Is live fire training the only way to train firefighters to prepare for fires?
#138	How can we conduct live fire training to minimize risk and exposure?
#139	What is the effectiveness of virtual training as compared to live training?
#140	What is the impact of online training vs. traditional training on the quality of service?
#141	What generational differences for online training should be taken into consideration?
#142	What is the overall assessment of online learning for firefighters?
#143	How can virtual reality training be used for incident command training?

Focus 4	Realism in Training
#144	Specific to volunteer fire departments, are established training requirements realistic and essential?
#145	How can initial training be directed more toward achieving expertise in critical skills?

Focus 5	Other
#146	What is the relationship between training toward a certified program and the impact training has on firefighter safety?
#147	What is the value of traditional formal higher education as well as continuing education and recertification?
#148	What training is needed for responding to emerging issues like violence, riots, and mass shootings?

TOPIC 2: *Tactics*

Focus 1	Tactical Effectiveness
#149	How can current fireground tactics be improved?
#150	How does water applied in the structural environment work, and what tactic is most effective without bias toward any particular approach?
#151	What tactics are most effective in covering large areas, especially in a mobile environment during wildland firefighting?
#152	What training and tactics are needed for the wildland/urban interface (WUI)?
#153	How are urban firefighting and wildland firefighting in the WUI environment different in terms of equipment, training, and tactics?
#154	Does two-in/two-out increase firefighter safety?
#155	If statistics regarding those who rescued firefighters who declared a mayday are examined, are Rapid Intervention Teams effective?
#156	How does hoarding affect fire operations?

Focus 2	Historical Analysis
#157	What are the historical trends regarding tactics? How have they changed? When did they change? Why did they change?
#158	What can be learned from reviewing near-miss reports regarding safety issues?

Focus 3	Best Practices and Standards
#159	What is the current state of best practices in fire departments?
#160	What are common elements of specialized groups of fires (non-residential structures)?
#161	How well do the national standards (NFPA 1710 and 1720) translate to local contexts for communities and coverage, especially regarding urban vs. rural and wildland?

Focus 4	Decision Making
#162	How has the simplification of training impacted the individual's ability to make quick decisions?
#163	What impact does having access to technology have on a department's ability to make decisions? How much technology provides too much information to the point of decision paralysis?

Focus 5	Staffing and Equipment
#164	What is the best way to measure what and how much staffing and equipment a department needs?
#165	What are the safety and risk factors of various crew sizes inside an Immediately Dangerous to Life or Health (IDLH) environment?
#166	What type of alternative tactics and support vehicles can be used?
#167	Should the fire service be building out systems to respond to the exceptional situation that rarely occurs or to manage the frequent occurrences with the ability to adapt to the exceptional situations?

TOPIC 3: Tools, Equipment, Apparatus

Focus 1	Technology
#170	Are there new risks concerning new fire service tools, such as lithium-ion batteries in chain saws?
#171	How have changes to hose manufacturing impacted operating ranges?
#172	How does the "non-standard" operations mode of thermal imagers impact their use? How common is it for the displayed temperature to be significantly cooler than the actual temperature?
#173	What are the benefits of electric apparatus and tools? Consider topics such as firefighter health, cost, durability, and fossil fuel reliability.
#174	What is the impact of diesel exhaust on firefighters and the environment?

Focus 2	Road Safety
#175	What effective training is needed to reduce fire service vehicle crashes?
#176	What is the effectiveness of chevron stripping on apparatus?
#177	What role do social pressure and pride have on apparatus design choices?
#178	What do fire departments have to consider regarding autonomous vehicles? For example, fire apparatus park where self-driving cars don't expect cars to be.
#179	What is the effectiveness of lights and sirens on vehicles responding to an emergency?
#180	What is the frequency of fire apparatus causing second accidents on roadways?

Focus 3	Air Quality
#181	What is the effectiveness of air filtration in fire engine cabs and ambulances?

TOPIC 4: Personnel Protective Equipment (PPE)

Focus 1	Design
#182	What different layers are needed for various tasks?
#183	What is the best balance between thermal protection and breathability?
#184	What is the impact of PPE on the functionality of each piece and the ensemble as a whole?
#185	Should we compare testing PPE for roadway incidents in a similar manner as roadway workers?
#186	What is the effectiveness of liners added to PPE that are designed to inhibit absorption of toxins?
#187	How can the fire service industry better track the results of incremental and significant changes in PPE?
#188	What is the thermal protective performance of each piece of PPE and the total ensemble?

Focus 2	Fit
#189	What is the impact of ill-fitting PPE on female firefighters?
#190	What differences should be considered between male and female PPE for fit, sizing, and design?

Focus 3	Use
#191	What is the relationship between PPE and operational tactics?
#192	What are the updated measurements on thermal conditions stemming from improved knowledge of burn causation?
#193	What type of cross-contamination occurs when structural PPE is worn to non-fire-related emergencies?
#194	How can individual and institutional resistance to changes in PPE be addressed?
#195	What is the general thermal stress on the individual as far as the convection heat transfer through PPE?
#196	How can fire departments increase compliance and adherence to PPE policies and regulations?
#197	What is the connection between PPE technology to key metrics like injury rates?
#198	What is the effectiveness of National Fire Protection Association standards regarding contamination measures for various sized departments?

Focus 4	Care
#199	What are the best practices for cleaning methods and decontamination?
#200	How can firefighters be proactive regarding contamination issues (as in, how can they keep gear from getting dirty in the first place)?
#201	In terms of PPE, how clean is clean and how dirty is dirty? What are the common benchmarks for these terms?
#202	What are the barriers to changing PPE care and cleaning, and what can address these barriers?

TOPIC 5: Community Risk Reduction (CRR)

Focus 1	Public Education and CRR
#203	What do citizens understand and know about fire safety?
#204	How can the fire service better disseminate messages to the public, considering various environments and socio-economic factors?
#205	How can the fire service and fire departments measure success related to CRR efforts?

Focus 2	Risk Assessment
#206	What are the comprehensive risks the fire service needs to address to reduce fires and other hazards?
#207	How can the fire service address risk issues from a proactive point of view?
#208	What can be learned from cities that have significantly reduced fire-related deaths, both civilians and firefighters?
#209	Is there a relationship to the life loss reduction and frequency of fires compared to building codes and the CRR environment in the community, and if so, what is it?
#210	What models of successful code enforcement in cities can be replicated?
#211	What types of direct effects do things like defensible space and building materials have on the WUI environment related to CRR?

Focus 3	Technology
#212	Is there a more effective smoke alarm and/or residential sprinkler than what's currently on the market?
#213	What renewable and emerging energy technologies will the fire service need to address?
#214	What tactics are needed to respond to advanced battery fires, flammable refrigerants, and solar panels?

TOPIC 6: *Fire Station Design*

Focus 1	Fire Station Design
#215	What are the effects of the fire station location on community property values?
#216	What is the most efficient way to get rid of diesel exhaust in fire stations?
#217	How does shared air in a fire station affect the health of firefighters?
#218	How does fire station design (lighting, acoustics, color schemes, etc.) affect the behavioral health of firefighters?
#219	What is the effectiveness of training props in fire stations?
#220	What are the benefits and disadvantages of open dorm rooms vs. individual rooms and common bathrooms vs. separate bathrooms?

DOMAIN 3: Health and Safety

General Recommendations from the Jury Deliberations

- Research is needed to address all aspects of improving health and safety, including topics such as:
    - Identifying causal links between occupational factors and injury/illness/disease/death;
    - Devising, testing, implementing, and testing the efficacy of mitigation strategies; and
    - Evaluating the most effective communication and dissemination strategies to effect change.

- Firefighter health and safety research projects need to identify who is most at risk or most vulnerable to given health and safety concerns. The programs need to be tailored differently for various groups.

- Previous research in this domain may need to be re-disseminated to the fire service as there is a general belief that research is not reaching practitioners. Also, practitioners may need education/training on how to access published research.

- The fire service would benefit from implementation science; there is strong need to translate research to application. This can be scaled to apply to multiple groups.

- Researchers from different disciplines (such as medicine, public health, physiology, biomechanics, physical therapy, economics, social work, women's health, implementation science, and cognitive psychology) are encouraged to help address issues in the fire service because of their variety of perspectives.

- Researchers must be attentive to the needs of a diverse fire service.

Reminder: The research topics are not listed in order of priority.

TOPIC 1: Occupational Cancer

	Recommended Research Focuses Should Include
#221	Firefighter exposure
#222	Managing exposure risks
#223	Effective cancer screening
#224	Personal/incident reporting
#225	Impact on family members

TOPIC 2: Cardiovascular Health

	Recommended Research Focuses Should Include
#226	Risk stratification
#227	Medical evaluations
#228	Blood work
#229	Hypertension
#230	Electrocardiogram (ECG) screening
#231	Overexertion

TOPIC 3: Behavioral Health

	Recommended Research Focuses Should Include
#232	Depression
#233	Anxiety
#234	Sleep
#235	Substance use (including alcohol and marijuana), measures of impairment, and how to educate firefighters on what these substances can mean for death benefits
#236	Post-Traumatic Stress Disorder (PTSD)
#237	Suicide
#238	Workplace abandonment, loss of "fire family" after retirement or termination
#239	Occupational violence (internal and external): individual safety assessment, harassment/assault/toxic work environment, retaliation, LGBTQI issues, bystander training, protection from the community
#240	Access to fire service specific providers and culturally competent providers

TOPIC 4: Major Health Concerns/Diseases

	Recommended Research Focuses Should Include
#241	Metabolic Syndrome (hypertension, body fat, obesity, nutrition, etc.)
#242	Respiratory diseases
#243	Kidney health (especially rhabdomyolysis)

#244	Neurodegenerative diseases (Parkinson's, dementia, etc.)
#245	Biomarkers of effect (e.g., stress hormone, saliva, exhaled breath)
#246	Testosterone (levels, supplementation, etc.)
#247	Nutrition

TOPIC 5: *Occupational Exposures*

	Occupational Exposures
#248	What are the health outcomes regarding the "clean cab" concept?
#249	What ergonomic considerations should be made regarding using tools and equipment, with reference to seatbelt research, Self-Contained Breathing Apparatus (SCBA) fit, and wearing different gear for different types of calls?
#250	How would a fire department benefit from a departmental wellness advocate?
#251	How does the ambient environment (noise, heat, particulates, and friction) affect firefighters?
#252	What are the effects of fire service culture on overall health and wellness?
#253	What strategies can be used to increase management buy-in to allow for on-duty exercise?
#254	What are the effects of per- and polyfluoroalkyl substances (PFAS) and other toxic chemicals?

TOPIC 6: *Sleep and Fatigue*

	Sleep and Fatigue
#255	How do sleep habits, patterns, and disorders impact firefighters' health and wellness?
#256	How should the fire service best measure fatigue and its impact on performance?
#257	What are the differences between mental and physical fatigue in firefighters?
#258	How can physiological monitoring and biochemistry be used to study fatigue?
#259	How do shift schedule and sleep deprivation impact firefighters' health and fireground effectiveness?
#260	Would the fire service benefit from a sleep and cardiovascular health annual meeting?
#261	What would a model Fatigue Risk Management program consist of?
#262	Is there a correlation to fatigue with the Psychomotor Vigilance Test?

TOPIC 7: *Reproductive Health*

	Reproductive Health
#263	What guidelines and policies are needed for pregnant firefighters? Topics should include guidelines for firefighters, fire departments, and health care providers. Policies should include duty restrictions, return to work procedures, and breastfeeding considerations.
#264	What are the health risks for firefighters' offspring?
#265	Are there infertility issues because of firefighters' duties?

TOPIC 8: Preventive Medicine

	Preventive Medicine
#266	What preventive factors can benefit firefighters, including baseline and annual physicals?
#267	Do injury prevention and risk assessments include both physical and mental injuries?
#268	Can flexibility protocols (to increase range of motion) serve as preventive medicine to help reduce injury rates?

TOPIC 9: Fitness

	Fitness
#269	Why do some departments not have a wellness/fitness program, and what are the barriers to implementation?
#270	Is Candidate Physical Ability Test (CPAT) the best model for physical fitness and ability testing?
#271	How can the fire service measure a baseline fitness level and ongoing/annual assessments?

TOPIC 10: Nutrition

	Nutrition
#272	What guidance could a registered dietician provide to firefighters?
#273	What best practices from the American Cancer Society and other like organizations can the fire service adopt to strengthen their diet and nutrition guidelines for cancer prevention?
#274	How does nutrition affect a firefighter's health and wellness, including supplements, caffeine, and energy drinks?

TOPIC 11: Financial

	Financial
#275	What are the financial barriers related to health and safety, and what strategies can overcome these barriers?
#276	What is the economic impact of poor health behaviors?

TOPIC 12: General Health and Wellness

	General Health and Wellness
#277	How can the fire service contribute to making improvements to the overall health of firefighters?
#278	How do behaviors outside of the fire department affect wellness?
#279	How can resilience be improved?
#280	What is the impact of firefighting on volunteer firefighters, wildland firefighters, fire investigators, fire trainers, etc.?
#281	How do social relationships and social supports impact firefighters' health and wellness?
#282	What are the health concerns of women and minority firefighters?
#283	Should a return-to-work protocol be added to NFPA 1582?
#284	How does aging affect the health of firefighters, especially in the volunteer fire service? Topics to be studied include musculoskeletal issues, sensory impairments, cardiovascular disease risk factors, weight gain, cognitive impairments, and seizures?

#285	What chronic conditions are associated with firefighting?
#286	What genetic tendencies do firefighters have, and can this be supported by baseline health information?
#287	What health concerns exist related to mobility, including joint vulnerability and improper fitting or restrictive gear? How can mobility assessments (DARI Motion Technology, Dartfish, Functional Mobility Scale, goniometer) be used?
#288	What types of wellness testing and assessments are necessary for firefighters, and are they the same for all firefighters?
#289	What are the biometric requirements for various personnel levels based on the amount of work firefighters must do?
#290	What, if any, are the unique health and wellness concerns for wildland firefighters, specifically work hygiene, sleep hygiene, and shift structure?
#291	How can the fire service better inform healthcare providers on the issues related to firefighters?
#292	Are there benefits to using saunas to "sweat out toxins"?

TOPIC 13: *Messaging*

	Messaging
#293	How can studying cognitive psychology help understand how to increase firefighter buy-in and decrease the fear of sharing health data?
#294	How can the fire service create unified messaging to develop and disseminate health and wellness efforts?
#295	How can researchers better disseminate information to the practitioners?

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APPENDIX B:
WORK GROUP WORKSHEET-TEMPLATE

2021 Research Agenda Symposium
Facilitator Worksheet

Domain:

Question:

Topic:

What Data is needed?

What Technology is needed?

Define what an "Effective Measure" would be for this Domain/Topic.

What type of Research is needed?

What discipline(s) of Research should be engaged?

What Public Policy/Social Science Inputs are needed?

APPENDIX C:
DOMAIN 1 WORK GROUP WORKSHEETS

Worksheets are provided with minimal edits for informational purposes for potential researchers.

2021 Research Agenda Symposium
Facilitator Worksheet #1

Domain: Hiring/Retention/Advancement

Question: How do we get people in, keep them, and help them grow?

Topic: Effective Leadership

What Data are needed?
Qualitative
- Interviews
- Focus groups
- Case studies
- Policy review
- Promotional study materials review
- Social network posts (where applicable)
- Officer training and professional development review

Quantitative
- Surveys
- Promotional data
- Longevity data
- Employee evaluations / Discipline data
- Labor issues
- Leveraging existing datasets

Other (Specify)
- Social network analysis – nodal distances

What Technology is needed?
1. Survey tools (e.g., survey monkey, Qualtrics)
2. Ways to collect qualitative data (e.g., transcription, recording)
3. Tools to integrate existing datasets
4. Virtual training scenarios
5. Video production/ vignettes
6. Tools to connect with interview subjects (zoom, teams, etc.)

Define what an "Effective Measure" would be for this Domain/Topic.
- Numbers and Rates of personnel trained or credentialed as leaders (e.g., Executive Fire Officer, Chief Officer Designation) or other trainings/credentials
  - o Establish baseline measures for minority totals at specified time frame.
- The number of organizations that are engaged in national professional development models. Overall evaluation of these programs for bias.
- The number of departments with the promotional process in-house vs. contracted out to professional program.
- Effective measures should be tailored to the local settings and type of departments.

What type of Research is needed?

Required Level of Expertise. Research to focus on required levels of expertise and identified skillsets for leadership relative to the environment (e.g., size of department, type of department) is needed. Exploration of effective leadership characteristics and how success can be measured would be useful. A survey of followers to evaluate leader vs. manager characteristics and overall choice to follow based on leadership vs. rank would also be helpful. Evaluation of leader fit to the crew or department is needed.

Training. Research on training effectiveness should expand beyond traditional fire service tasks to include business skills, social/emotional interaction skills, conflict management, personnel management, and leadership skills. The efficacy of training processes for leadership development needs to be examined specifically to the type of role (e.g., company officer, chief level) and nature of the department. Both formal and informal trainings processes should be studied.

Developing Effective Leadership Skills. Research on the best approaches to develop effective leaders for both the career and volunteer fire service through both quantitative and qualitative measures is needed. Research questions also should focus on what skill development tools are currently missing and what drives leaders to leave their positions or departments. An assessment of fire department professional development and officer training is necessary. For example, what are organizations doing to help leaders succeed?

Metrics and Measurement of Effective Leadership & Management Skills. Consistent metrics and definitions to measure effective leadership and management are needed that can be tailored to the different size or type of department. Both qualitative and quantitative measures of success and efficacy will likely provide insight into what makes a "good" leader. Effectiveness of management and leadership operations (e.g., development and implementation of adequate policies and procedures, compliance with national standards) and interpersonal skills. Focus also should be on what metrics can be used to measure success in training and developing leaders beyond just meeting core competencies. For example, evaluate personality, attitudes, values, communication skills, organizational understanding, rules, organizational culture, power hierarchy, and politics, etc.

Defining Effective Leadership & Management Skills. Research that focuses on what makes a strong leader both in operational and interpersonal capacities is needed. Examining perceptions of leaders and their followers also is needed. The focus should be on generational differences and varying definitions and expectations of effective leaders. Research on measurable and meaningful benchmarks of success would benefit the fire service. Research also should focus on the measurable impact of leadership and management on departments related to morale and motivational climate.

Motivation for Leadership. Research is needed to examine why people choose to be leaders in the fire service, including both the motivators and barriers to choosing leadership. Differences in motivation should be examined specifically by subgroups, including various ages, generations, race/ethnicity, and gender differences. Research should examine organizational and self-prescribed barriers to advancement.

DEIB and Effective Leadership. With a focus on more diverse fire service, research should include a focus on what leaders need to know to promote an inclusive environment. Leadership and management research also should include a focus on emotional intelligence as a key promoter of DEIB for fire service leaders.

Best Practices. Research on current and emerging best practices in effective leadership and management development, training, and approaches is needed. Research on training approaches that integrate innovations such as role-playing scenarios, peer feedback, and personnel management is of particular interest. Best practices in identifying and engaging leaders in other organizations and countries may prove useful.

Informal Leaders. Research on leadership and management within the fire service should expand to include informal leaders who serve as key opinion leaders within the department. Research questions include how to identify them, reach them, and engage them effectively.

What discipline(s) of Research should be engaged?
Economist
Sociology
Organizational Psychology
Measurement Design
Marketing/PR
Community organizers
Public Policy
Behavioral Economics
Educational Psychology
Political Science

What Public Policy/Social Science inputs are needed?
- Legal reviews (e.g., decrees that exist, legal expectations for promotion)
- Promotion policies
- Civil service expectations, benefits, barriers
- National, regional, and department policies (e.g., certifications)
- Teaching departments to research themselves effectively

Relevant Resources
- Example of behavioral economic frameworks: https://hbr.org/2017/10/the-rise-of-behavioral-economics-and-its-influence-on-organizations
- Research methodology for leadership: https://www.researchgate.net/profile/Linton-Freeman-2/publication/239228599_The_Development_of_Social_Network_Analysis/links/54415c650cf2e6f0c0f616a8/The-Development-of-Social-Network-Analysis.pdf
- Be, Know, Do: Leadership the Army Way https://www.armyheritage.org/wp-content/uploads/2020/08/FM-22-100-Aug99.pdf

2021 Research Agenda Symposium
Facilitator Worksheet #2

Domain: Hiring/Retention/Advancement

Question: How do we get people in, keep them, and help them grow?

Topic: Diversity/Equity/Inclusion & Belonging (DEIB)

What Data are needed?
Qualitative
- Interviews
- Focus groups
- Case studies
- Social network analysis

Quantitative
- Surveys
- Economic analysis
- Leveraging existing datasets
- Social network analysis

What Technology is needed?
1. Survey tools (e.g., survey monkey, Qualtrics)
2. Ways to collect qualitative data (e.g., transcription, recording, social media)
3. Tools to integrate existing datasets
4. Virtual simulations related to training and education
5. Video production

Define what an "Effective Measure" would be for this Domain/Topic.
- Standardized definitions of DEIB are needed to monitor success. (If we do not all define it the same way, how do we establish a baseline or measure improvement?)
- Diversity (age, gender, ethnicity, sexual orientation) can be measured by type/location of department to assess longitudinal trends. These initial measures are needed to establish a baseline that should be representative of the fire service in general at a specified point in time. Ongoing specific time measures and trends can be monitored from baseline.
- Measure increase/decrease diversity percentages across departments/regions/demographics over specified time frame.
- Leverage existing census, American community survey, or other demographic datasets to assess community diversity measured against fire departments.
- Comparing metrics across regions will provide useful information and help to develop a broad/nuanced understanding of DEIB.
- Descriptive measures of diversity in hiring and training rates nationally/regionally may be useful.
- Inclusion and belonging are much more difficult to measure. Measuring inclusion will likely require qualitative research efforts to establish a baseline for the fire service. Focus groups and observation studies held in departments of different types, sizes, and regions will assist with understanding and initial evaluative measures of policy, practices, and overall culture. Based on the information gathered, quantitative measures can likely be established.
- Initial qualitative measures of equity should include evaluation and descriptions of hiring practices, candidate testing, and selection. Additional measures of incumbent equity will include an evaluation description of promotion testing and practices, policies, and overall management /leadership culture.

What type of Research is needed?

General Notes for Consideration. It was noted that research should be sensitive to the department/organizational needs and resources such as type of department (career, volunteer, combination), size, and region. Limitations to the generalizability of findings should be considered both in research design and dissemination.

The team also felt it was important that conversations around research needs in this area be prefaced with a clear explanation or definition of the concepts being referenced.

- ***Diversity*** – While traditional references to diversity include racial/ethnicity, sexual orientation, and gender, the team conceptualized diversity as also including diversity of thought, attitudes, perspectives, and generational differences. It was noted diversity research and diversity of the fire service must include both visible and invisible sources of diversity and that the fire service research should work toward diversity of both.
- ***Equity*** – It was discussed that our research recommendations are focused on equity (everyone getting what they need to be successful) rather than equality (people each getting the same resources)
- ***Inclusion*** – The team focused on the importance of promoting inclusion prior to and in conjunction with diversity efforts. It was noted that if fire departments seek to be inclusive, the result will be diversity. The team also decided the language should be amended to extend beyond inclusion to include *belonging* as it was conceptualized as a similar but complementary concept. Therefore, reference is made to "DEIB," which includes this concept in subsequent notes.

Consistent Metrics. Research needs should focus on developing a common set of metrics for the fire service to allow comparisons across and between populations. Suggestions for potential outcomes include domains from descriptive statistics (e.g., level of (percentage of) diversity compared to the population served) to job satisfaction, experiences of discrimination, and measures of culture. Metrics also should be designed within a framework/process that is useable and implementable by fire departments. Research should focus not only on the past and current efforts related to DEIB but should focus on what research will be responsive to the early qualitative findings, the needs in the future, and the evolving culture of the fire service. Standardized benchmarks that can be compared to other occupational groups were suggested as a possible research focus.

Organizational Bias. A data-driven approach to understanding the presence, impact, and assessment of organizational bias is needed. Further, research on how to identify and address and propose actions to eliminate organizational bias is also needed to help departments identify whether they have "blind spots," particularly related to organizational policies and processes.

Implicit Bias. Research on perceptions of issues surrounding DEIB (e.g., ways to approach, convincing personnel implicit bias exists, effective messaging, terms that create barriers) that also identify and address implicit bias is needed. Research should focus on defining and measuring the success or effectiveness of efforts to make departments and personnel more aware of both intentional and unintentional bias. Pre/Post-intervention (or education) measurement may be valuable.

Benefits of Diversity. As the fire service works to promote DEIB, research should focus on the benefits of diversity. Measurable outcomes of efforts to promote diversity may include job satisfaction, behavioral health implications, reduction of stigma, community expectations, service delivery, productivity, and job efficiency. These research efforts must have a broad understanding of diversity as defined in the introductory notes.

Creating a Diverse Fire Service. Research methods for evaluating and expanding diversity within the fire service include evaluation of effective recruitment methods and strategies (e.g., messages, avenues of recruitment). It was suggested that research focused on effectively changing culture and stigma around DEIB maybe benefit from examining the model of reducing the stigma that has been successful with other topics such as behavioral health. Research on the impact of consent decrees on DEIB is needed. Task analysis research to identify the types of candidates that best-fit job tasks and types is needed in a way that is sensitive to sub-sections of the fire service. Studies to effectively adapt successful models from other occupations are needed.

Cultivating a Culture of Inclusion. Research is needed on how the fire service and departments can promote a culture of inclusion. Research questions should focus on ways to promote inclusiveness within departments and provide the evidence to support successful strategies (e.g., mentorship across the career span, tailored roles within a department). The measurable impact of cultures that are inclusive is needed relating to personnel experience and department outcomes. Specific research is needed on the role of white male propensity to embrace DEIB and the effects of white male buy-in on DEIB constructs. Examples of relevant research may include the effectiveness of promoting DEIB allies, the impact of intervention efforts, and

successful mechanisms for inclusion. Empirical evidence about why people leave the fire service beyond department level exit interviews and/or why they choose not to enter is needed and must consider the type of department (e.g., career/volunteer/combination) and demographics (e.g., region, size). It should be considered that concerns related to inclusion and belonging also include white males and the realization that there are cultures that exclude personnel even among that population.

Role of Mentors/Sponsorship/Advocate/Champion/Coaching. Mentorship in its various forms (both formal and informal) was identified as a key factor in promoting DEIB. Given this, research is requested on how this role and relationship can best be leveraged to promote DEIB most effectively and measurable outcomes of such efforts.

The Role of Inclusiveness. Research is needed on the role and value of inclusiveness within the fire service, as well as the impact when inclusiveness is limited or missing with a focus on measurable outcomes (Example: when firefighters at a station are included in meals or picked on as part of the group rather than excluded and treated with silence). Perceptions of inclusiveness and belonging are an important research focus, as is understanding the stages of building an inclusive organization. Variations in inclusiveness by type of department should be qualified. This research should also include strategies for inclusion, motivators, detractors, and ways to overcome the lack of inclusion challenges.

Financial Cost of DEIB. *Research on* the financial impact of a lack of diversity and inclusion is needed in all department types. This research should evaluate the cost of lawsuits, consent decrees, policies, and a lack of retention [employee turnover]. Research should also focus on the positive financial impact of diversity and inclusion.

Organizational Cost of DEIB. While financial costs are an important focus of research as a means of promoting the importance of DEIB, research on the organizational costs in terms of personnel (e.g., behavioral health, productivity, belongingness, job satisfaction), organization (e.g., equity in service delivery, community satisfaction), and culture (e.g., innovation) are also needed.

Training on DEI. Research is needed to identify baseline education needs and concepts necessary to effectively promote DEIB in the fire service (e.g., bias, stigma, practices, policies). Research should focus on the concepts of DEIB and how they are integrated into training, how they relate to measurable performance benchmarks, and how they are operationalized. The measurable impact of and best approaches for including DEIB in leadership training, company officer training, and/or in recruit school needs further research.

Leading & Emerging Practices. The discussion focused on the continuum of practices, including prevailing (what is currently being done), leading (what are identified as the best practices currently), and emerging (newly evolving practices). Research should focus on what efforts are most effective related to promoting DEIB. The focus should be on empirically validated successes within the fire service and on other occupational groups with similar structures/functions and recruitment pools.

Barriers to DEIB. Research should focus on what barriers exist to DEIB within different department types. Researchers should identify effective methods, messaging, and training models that can be used to promote DEIB efforts. Specifically, a focus on the role of promoting DEIB through leadership training was recommended as a research approach. Research on effectively responding to challenges to DEIB was a focus of the conversation.

What discipline(s) of Research should be engaged?
Economist
Sociology
Organizational Psychology
Measurement Design
Marketing/PR
Community organizers
Psychology
Public Policy
Behavioral Economics
Educational Psychology
Political Science
Legal
Epidemiology

What Public Policy/Social Science Inputs are needed?
- Legal reviews (e.g., decrees that exist, legal expectations)
- Hiring and promotion process
- Civil service expectations, benefits, barriers
- National, regional, and department policies (e.g., certification)
- Teaching departments to research themselves effectively

Related Resources
- The IAFC has a guide to Diversity, Inclusion, and Equity: https://www.iafc.org/topics-and-tools/resources/resource/guide-for-creating-a-diverse-and-inclusive-department
- https://perception.org/research/implicit-bias/
- https://implicit.harvard.edu/implicit/takeatest.html
- All of the NFPA 1000 series Professional Qualification Standards are based upon job task analyses and job performance requirements.
- Spot on the Today show worth watching about implicit bias https://www.today.com/video/what-is-implicit-bias-2-experts-on-how-to-spot-it-101450310002
- GARE - Government Alliance on Race & Equity

  It is suggested that the research agenda encourages researchers to consider existing work in both the peer-reviewed literature and organization efforts/report. It is suggested that a list of relevant organizations within the fire service be listed as a resource for those less familiar with the fire service organizations (e.g., IAFF, IAFC, NVFC, IPSDI, NFPA, FDSOA, CFSI, Women in Fire, BPFF, Hispanic Professional, NAFTD, IFSI, FPRF, FCSN, CPSE, Past FEMA Grants) as well as Fire Service Partners (e.g., ICMA, NAEMSP, NAEMT, FHRM)

2021 Research Agenda Symposium
Facilitator Worksheet #3

Domain: Hiring/Retention/Advancement

Question: How do we get people in, keep them, and help them grow?

Topic: Recruitment (Career/Volunteer)

What Data is needed?
Qualitative
- Interviews
- Focus groups
- Case studies

Quantitative
- Surveys
- Economic analysis
- Leveraging existing datasets

Other (Specify)

What Technology is needed?
1. Effective web design and social media
2. Survey tools (e.g., survey monkey, Qualtrics)
3. Ways to collect qualitative data (e.g., transcription, recording)
4. Tools to integrate existing datasets

Define what an "Effective measure" would be for this Domain/Topic.
Demographics of the fire service across time nationally – where are we? How are we changing? Number of recruits,

NFPA 1710/1720 Standards – operational standards…use to develop recommendations and measures

Metrics will not be the same for gender/ethnicity – cannot include those all as "minorities" …same things that affect women not the same as every other group.

Standardized Benchmarking – how many people did I reach? How many expressed interest? How many joined? How many stayed around over time? - performance measures identified and shared across departments – Standard set of questions/measures/definitions

What are we trying to do? What are we expecting, and can we reach it? Should we say yes to everything? We don't have enough people, or do we need more people to do this?

What type of Research is needed?
General discussions about research needed to understand and improve recruitment focused on the need to understand the nuances of need within the fire service as there are stark differences between types of departments (e.g., career, volunteer, combination), regions, size of the department, and department structure. Recommendations following should consider these specific variations.

Recruitment Methods. Research on methods for successfully recruiting both career and volunteer firefighters is needed with sensitivity to the different challenges the different types of firefighters/fire departments face. Potential questions include where and how firefighters are being recruited most successfully, how firefighters learn about and the fire service, and what messages are most effective for engaging them. Quantifying the benefits of investing in recruitment efforts to achieve the strongest applicant pool is necessary. Understanding the profiles (e.g., personality, traits) of successful firefighters is needed to be able to target recruitment efforts to those most likely to engage in both the career and volunteer fire service. Recruiting from within the fire service also should be the focus of future research. Understanding the role of multi-generational families in the fire service and how to leverage and expand those relationships to provide models to a wider variety of recruits may provide useful insights. Further, research should focus on how to successfully transition between roles as a volunteer and career firefighter. The unique role of the military/veterans populations in the recruitment process also should be explored.

Barriers to Recruitment. Research to understand the barriers to recruitment across a broad spectrum of departments, regions, and communities is needed. Studies are needed to understand what preconceived perspectives and expectations potential recruits face that limit their interest in joining the fire service. Both real and perceived barriers to entry to the fire service need to be understood more fully. Research is needed to
 understand if/what requirements are in place that limits recruitment as is well as whether those are applicable to the current fire service/department needs. Studies focused on those who enter and/or train but do not complete the process may provide valuable insight. Research on other similar occupations or volunteer opportunities that are available and why people choose them instead will help explicate the benefits of the fire service.

Effective Recruitment Messaging. Research is necessary that explores the effectiveness of messages to the community about what serving as a career, or volunteer firefighter is like. It also is important to understand the perspective of potential recruits and what they see as the role of serving in the fire service. Research on what tailoring of messages and avenues of dissemination are most effective for diverse recruitment. Specific to volunteer fire departments, it is important to understand if potential recruits perceive the different tasks that are available in volunteer departments and to understand ways to effectively message the wide variety of roles that are possible.

Community Perceptions. To improve recruitment in the fire service, research should focus on perceptions, expectations, and knowledge in the community about the fire department and how it operates (e.g., career vs. volunteer). Research to identify best practices for engaging and educating the community, as well as metrics to monitor success, is necessary. Research should focus on how potential recruits within the community understand the tasks/roles within the fire department and ways to engage beyond serving as a line firefighter. An understanding of what draws people in and how that matches with different cultural groups within the community, as well as ways to leverage and/or change the perceptions, will be important. Developing an understanding of the image volunteer departments have in their specific sub-populations within the community and what draws people in or pushes them away, as well as a way for departments to assess this themselves, can help build a stronger recruitment plan. Research should focus not only on the roles of firefighting but also the tasks (e.g., fundraising) that are required of personnel to ensure that recruitment efforts accurately reflect the job they are being recruited for. Research should examine volunteer recruitment in communities, in general, to determine if similar volunteer opportunities are experiencing comparable declines in interest.

Recruiting for the Future. While research is needed to understand the current recruitment environment, studies should also consider what essential skills and capabilities firefighters will need in the future, as well as what the recruitment environment will be, are necessary for sustainability. Specifically, research should focus on whether and how the fire service is or is not welcoming to a wider variety of individuals.

Models of Success for Recruitment. Research should focus on innovative models of recruitment and best practices for recruiting that have been successful nationally. Understanding effective messaging, particularly to build diversity among non-traditional groups, is needed in both career and volunteer departments. The efficacy and effectiveness of recruitment models should be assessed to guide future efforts.

Community Evaluation. As communities evolve, it is important for research to focus on what the appropriate model (e.g., career vs. volunteer vs. combination) and level of service are for the setting, how and when the model should shift. The effectiveness of different approaches and cost/benefit analysis are important for departments to be able to make informed decisions.

Promoting Diversity in Recruitment. Research is necessary to understand what effective methods are used or could be used to more widely recruit a variety of experiences, backgrounds, and perspectives – both visible and invisible. Diversity in this instance should include but not be limited to a diversity of gender, race/ethnicity, socioeconomic status, sexual orientation, and generation. Specifically, research on how to match the diversity in the fire service to the communities they serve also is important. Understanding the impact of this diversity on enhancing the fire service is necessary. Approaches that focus on what profiles of individuals who choose to join the fire service, particularly from diverse backgrounds, will likely provide insight into targeting efforts for future recruitment.

Metrics for Recruitment. There is a need for unified metrics and operational definitions specific to recruitment activities to allow for comparison between groups, benchmarking, goal setting, and measurement of success. Examples include but are not limited to defining who is considered a successful recruit, identifying subsections of recruits for targeting, defining what successful recruitment is, and ways to quantify recruitment efforts.

What discipline(s) of Research should be engaged?
Economist
Sociology
Organizational Psychology
Measurement Design
Marketing/PR
Community organizers
Public Policy
Behavioral Economics
Educational Psychology
Political Science

What Public Policy/Social Science Inputs are needed?
- Do policies support/restrict recruitment? Are there policies that impede recruitment unnecessarily (e.g., restrict the number of firefighters, processes that are not useful)
- Reimagining the fire department – is it going to be a public safety department? Different model? Recruit better? Hire better?
- Realities of what fire/ems is…what can we legitimately expect? Is the age of volunteerism going to look different? Do we need separate fire departments in a small area…could we consolidate?
- Why do people struggle to make necessary steps/decisions?
- Understanding bias – do we promote an inclusive environment.

2021 Research Agenda Symposium
Facilitator Worksheet #4

Domain: **Hiring/Retention/Advancement**

Question: **How do we get people in, keep them, and help them grow?**

Topic: **Hiring**

What Data are needed?
Qualitative
- Interviews
- Focus groups
- Case studies
- Hiring announcements/promotion messaging
- Legal requirements
- Preference policies

Quantitative
- Surveys of recent hires
- Economic analysis of pay scales and benefits offered
- Leveraging existing datasets like community demographics, current employees, Candidate physical ability test results, Westlaw, Nexis/Lexis, etc.

Other (Specify)

What Technology is needed?
1. Survey tools (e.g., survey monkey, Qualtrics)
2. Ways to collect qualitative data (e.g., transcription, recording)
3. Tools to access and integrate existing datasets
4. Communication capability
5. Virtual meeting capability

Define what an "Effective Measure" would be for this Domain/Topic.
- Demographics of successful hiring across domains that identify bottlenecks where we are losing strong candidates across and between sub-groups using clear and consistently defined metrics
- Demographics of hiring compared to those recruited and retained
- Percentage of local governments (by region or state) with hiring preferences by type. For example, military preference or paramedic credential preference.
- Percentage and geolocation of civil service jurisdictions

What type of Research is needed?
Hiring Tests. Research is needed to review existing hiring tests and processes to identify limitations to existing methods (e.g., relationship to job tasks) and outputs (e.g., lack of diversity). Focus also should identify the predictive validity of skills and measured variables (e.g., critical thinking, communication, strength) and their relationship to competencies once on the job. Consideration should be given to the competencies needed that are specific to the job tasks (e.g., entry firefighter, support personnel, leadership positions) and department needs (e.g., career, volunteer, combination).

Hiring Approach. Research should focus on examining the hiring process to ensure it is a fair and equitable process that accurately measures competencies. Research on approaches also should include identification of unnecessary barriers (e.g., timing or location of testing or interviews, testing cost) and ways to overcome those barriers. Questions also should focus on the entire hiring process, including engagement and education early in the career identification process (e.g.. middle schools, high schools). Research on the impact of preferential hiring and ways to leverage the process to promote diversity also is warranted. Research on the impact of generational differences and/or ways to leverage those differences in hiring processes needs to be explored.

Leading & Emerging Practices. Research identifying successful practices in hiring processes and testing that promote diversity and selection of strong candidates is needed. Studies should include a focus on what is task-relevant for the needs of the current and future fire service job requirements. Research also should focus on best practices for educating potential candidates early in their career search about requirements and qualifications.

Organizational Environment/Needs. Research is needed that focuses on the ways organizational environments promote or limit inclusion and the effectiveness of approaches to overcome those limits. Evidence to validate the utility of allowing personnel to join the fire service in specific roles that are not line firefighting, particularly in the volunteer fire service, is needed.

Barriers to Effective Hiring. Research is needed to identify what structural and functional barriers exist to hiring more diverse candidates. The focus should include both formal (e.g., rules, requirements) and informal (e.g., traditions, perceptions) barriers to effective hiring as well as ways to overcome identified barriers.

Metrics for Hiring. Consistent, operationally defined metrics for assessing hiring processes are needed to be able to accurately monitor changes across times and departments. Tools need to be able to identify where in the hiring process strong candidates may be falling out and for what reasons.

What discipline(s) of Research should be engaged?

Economist
Sociology
Organizational Psychology
Measurement Design
Marketing/PR
Community organizers
Psychology
Public Policy
Behavioral Economics
Educational Psychology
Political Science
Legal
Epidemiology
Fire Service Organizations (e.g., IAFC, IAFF, NVFC)
Non-Fire Service Organizations – (e.g., ICMA, SHRM, EGLG)

What Public Policy/Social Science Inputs are needed?

- Legal reviews (e.g., decrees that exist, legal expectations)
- Hiring and promotion process evaluations
- Civil service expectations, benefits, barriers
- National, regional, and department policies (e.g., certification)
- Teaching departments to research themselves effectively

Relevant Resources

- A very "outside the box" concept that could be applied to hiring comes from the immigration of all things. Once concept started in Australia, then the UK is called a Points Based Immigration Scheme: https://www.gov.uk/government/publications/uk-points-based-immigration-system-employer-information/the-uks-points-based-immigration-system-an-introduction-for-employers
- Link to volunteer recruitment / retention. http://mehendershot.org/gh2017ifsjlm/
- Building off the concept of "praxis" mentioned Monday...suggest cataloging and analyzing innovative recruitment/hiring/training programs. Focusing on successes may provide actionable insights. E.g., https://www.ajc.com/news/local/clayton-county-schools-graduates-first-class-students-firefighter-program/LbgdOSiEZzTJpVWUV65SKJ/
- Civil Service Employment: Working for Government https://www.thebalancecareers.com/civil-service-employment-525874

2021 Research Agenda Symposium
Facilitator Worksheet #4

Domain: Hiring/Retention/Advancement

Question: How do we get people in, keep them, and help them grow?

Topic: Hiring and Advancement

What Data are needed?
Qualitative
- Interviews
- Focus groups
- Case studies
- Observational
- Promotional study materials
- Promotional testing materials

Quantitative
- Surveys
- Promotional demographics
- Leveraging existing datasets

Other (Specify)
- Concept mapping
- Mixed methods

NOTES: Change verbiage to "people skills" instead of "soft skills," and can use concept mapping dissertations to frame issues

What Technology is needed?
1. Survey tools (e.g., survey monkey, Qualtrics)
2. Ways to collect qualitative data (e.g., transcription, recording)
3. Virtual meeting capability (Zoom, Teams, Google)
4. Tools to integrate existing datasets

Define what an "Effective Measure" would be for this Domain/Topic.
- Evaluate and standardize definitions of ranks for departments
- Standardized methods for promotional processes and practical assessments are needed to monitor success.
- Measure increase/decrease diversity percentages in promotions across departments/regions/demographics over a specified time frame.
- Descriptive measures of diversity in hiring and training rates nationally/regionally may be useful.

What type of Research is needed?
Measuring Progress. Research is needed on the development and implementation of reliable and valid tools for measuring improvement in skills across time, as well as predictive tools for strong promotional candidates. Developed measures of competencies at different stages in the promotional process also are needed.

Promotional Exams. Research should focus on the development and validation of promotional exams that adequately assess a diverse range of skills and competencies specific to the promotion stage. Studies should focus on validating testing processes that are legally defensibly, reliable and valid while minimizing bias.

Qualifications & Competencies. Research is needed on the minimum qualifications and competencies across a variety of domains (e.g., operational knowledge, interpersonal skills) necessary for leadership positions that are specific to type of position and department structure.

Best Practices. Mixed methods research is requested that identifies what a "good leader" is by measuring recognized successful leaders. Reviews of current promotional exams and assessment processes to identify those that can be considered best practices also are needed.

Barriers to Promotion. Research is needed that focuses on barriers to promotion for women and non-white male candidates. Research is also needed to evaluate barriers for presumed strong candidates who choose not to engage in the process. Barriers to an inclusive environment that supports and encourages promotion for diverse candidates should be explored.

Financial Implications. Research on the financial implications (both costs and benefits) to different promotional processes should be explored. Cost analysis should focus both on the individual and organizational (direct and indirect) financial implications.

What discipline(s) of Research should be engaged?
Economist
Sociology
Organizational Psychology
Measurement Design
Psychology
Educational Psychology
Legal
Epidemiology
Human Resource Organizations (e.g., SHRM)
County managers (e.g., ICMA)
Local government (e.g., ELGL)
Organizations – SHRM – HR
Political Science Research Methods

What Public Policy/Social Science Inputs are needed?
- Policies should be responsive to the type of department and position being studied
- Legal reviews (e.g., decrees that exist, legal expectations)
- Hiring and promotion process
- Civil service expectations, benefits, barriers
- National, regional, and department policies (e.g., certification)
- Teaching departments to research themselves effectively

2021 Research Agenda Symposium
Facilitator Worksheet #5

Domain: Hiring/Retention/Advancement

Question: How do we get people in, keep them, and help them grow?

Topic: Retention

What Data are needed?
Qualitative
- Exit Interviews
- Officer interviews
- Focus groups for those who leave and those who stay on the job
- Case studies of departments with good retention/ employee longevity
- Narrative reviews of success and failures

Quantitative
- Surveys of actives, those leaving early, and retirees
- Leveraging existing datasets (volunteer rolls, employee turnover)
- Social network analysis for positive and negative posts about firefighter job experience

Other (Specify)
- Mixed methods approach
- Review of existing literature (qualitative/quantitative) including but not limited to peer-reviewed literature, organizational resources/reports/programs, references in fire service trade magazines
- Annotated bibliographies/gap analysis/limits to generalizability

What Technology is needed?
1. Survey tools (e.g., survey monkey, Qualtrics)
2. Ways to collect qualitative data (e.g., transcription, recording)
3. Tools to integrate existing datasets

Define what an "Effective Measure" would be for this Domain/Topic.
- Standardized definitions of retention are needed to monitor success
- Standard metrics of accounting for volunteer personnel and classification of "active" members to allow for comparisons across time and between organizations. What is a minimal commitment to be considered retained?
- Percentage of firefighters who do not complete a full career to retirement by gender and ethnicity. It can also include geolocation by state/ region.
- Economic analysis: What is the cost to hire and train one firefighter?
- Impact Study: What are the costs in time, dollars, and system impact to fill a vacancy when a firefighter leaves the job [at varying time periods] before retirement?

What type of Research is needed?
Cost of Retention. Behavioral economic research is needed to explore the costs of retention or lack thereof and the overall impact on the department/community.

Measurement Resources. Research is needed to develop common metrics, definitions, and measurement tools. Climate surveys and their relationship to retention are of interest. Focus specifically on subgroups (e.g., race/ethnicity, gender, tenure as a firefighter, etc.) is warranted to be able to monitor retention effectively.

Barriers and Facilitators to Retention. Research is needed to assess barriers to retaining firefighters in both career and volunteer fire departments with consideration given to the type of department as well as other demographics (e.g., rural/urban/suburban, small/medium/large). Research should focus on both those who leave the fire service early to identify barriers and those who choose to stay to identify facilitators. Both organizational (e.g., benefits, schedules, funding) and individual factors (e.g., camaraderie, sense of duty, skill expectations, second/third jobs) should be explored.

Role of Training in Retention. Research is needed to examine the relationship between investments in training and its impact on retention. The impact of designated career progression paths and training goals on retention also should be explored.

Role of Funding in Retention. Research is needed to examine the role of adequate funding in retention efforts. Organizational funding is an area of interest (e.g., are underfunded departments less likely to retain firefighters, are departments appropriately investing in retaining good personnel) as well as individual funding (e.g., does tax relief/insurance/concerns over coverage if injured) effect retention. Cost-benefit analysis of retention efforts also is warranted.

Retention & Inclusiveness. Research should explore the relationship between inclusiveness and retention. This area of research should include examination of inclusiveness in general and not limit be limited to traditional "minority" groups but define inclusiveness broadly to include the environment for all firefighters. Behavioral research of station relationships, use of humor, mealtime interaction, unit training drills, and emergency response crew cohesiveness/performance is needed to assess the impact on retention.

Mentorship and Retention. Research is needed into what (if any) role mentorship (both formal and informal) plays in ongoing retention. The examination of mentorship also should include a focus on how individual or institutional bias may intentionally or unintentionally play into the relationship. The impact of mentorship and feedback or performance appraisals should be explored with consideration for department type.

What discipline(s) of Research should be engaged?
Economist
Sociology
Organizational Psychology
Measurement Design Community organizers
Public Policy
Behavioral Economics
Educational Psychology
Political Science
Psychology
Epidemiology

It is suggested that the research agenda encourages researchers to consider existing work in both the peer-reviewed literature and organization efforts/report. It is suggested that a list of relevant organizations within the fire service be listed as a resource for those less familiar with the fire service organizations (e.g., IAFF, IAFC, NVFC, IPSDI, NFPA, FDSOA, CFSI, Women in Fire, BPFF, Hispanic Professional, NAFTD, IFSI, FPRF, FCSN, CPSE, Past FEMA Grants) as well as Fire Service Partners (e.g., ICMA, NAEMSP, NAEMT, FHRM)

What Public Policy/Social Science Inputs are needed?
- Public policies on training/transportability and reciprocity of certifications
- Civil service expectations, benefits, barriers
- National, regional, and department policies (e.g., certification)
- Teaching departments to research themselves effectively
- Public policies around funding and their impact on department retention
- Developed metrics for fire departments to be able to research themselves

APPENDIX D:
DOMAIN 2 WORK GROUP WORKSHEETS

Worksheets are provided with minimal edits for informational purposes for potential researchers.

2021 Research Agenda Symposium
Facilitator Worksheet #1

Domain: Effective Operations

Question: How do we do the job effectively?

Topic: Training (maintaining proficiencies)

What Data is needed?
Qualitative: what does training look like; how are firefighters rating the effectiveness and social buy-in to training;

Quantitative: relationship between training hours and effectiveness on the job; CEU requirements for states; comparison of traditional education compared to online training (on the job and academies); effectiveness of individual compared to crew training; reviewing LODD and injury reports to determine where the weak areas of training curriculums exist

Other (Specify): what data is being collected regarding data (what are the metrics); a national standard for logging training; after-action reports may provide weak areas of a department if it shows up consistently

What Technology is needed?
1. Virtual live-fire training – comprehensive sensors and physicality associated with it
2. Virtual burn tables and VR (WUI/wildland)
3. Mental and behavioral health training (generally) and self-assessment or peer assessment tools/resources
4. Exposure risk reduction training (donning/doffing, etc. (with feedback (UV powders)
5. Functional fitness and kinesiology integrated into training programs
6. Nutrition and hydration training and tools for self/peer assessment
7. Rehab and recovery techniques and technologies/resources
8. An ability to adapt - training evolutions that truly mimic the fireground, including unknown factors. This would allow firefighters to train their critical thinking skills, flex roles, and tactics

Define what an "Effective Measure" would be for this Domain/Topic.
- Effectiveness of training (move past number of hours, number of participants, etc.)
- Assessment of proficiency (in the field - ties back to the effectiveness of training)
- Retainment of online learning and practical application to the field
- Transferability of training - from controlled environments to the field
- Moving from single subject training to true evolutions that include multiple topics of 'training' and skills
- Time to effectively put water on fire - possible measure of effective training
- An ability to flex or move on the fly on the scene as the call develops. Is there Plan B, Plan C, etc.
- Individual performing the skill → perform the skill as part of a team → the team performing the skill → the team working with other teams to perform the skill → overall success of a system
- The ability of the firefighter to retain basic skills learned during the academy and apply those principles to the job
- Training effectiveness based on safety of firefighters (LODD or serious injury)

What type of Research is needed?
- Is live-fire training the only way to train firefighters to prepare for fires?
- How can we conduct live fire training to minimize risk and exposure?
- Translation of training hours to doing the job well
- How do we develop their understanding and proficiency to make decisions in the fire environment in the most efficient manner?

- What elements of training make a difference on the fire ground?
- Are established training requirements realistic and essential (specific for volunteer departments and its relationship to retention and recruitment)
- How can our initial training be directed more toward achieving expertise in 'critical' skills?
- Effectiveness of virtual training compared to live training
- How many first responders are not certified?
- What would a national standard of certification look like?
- A consistent way to measure training transfer and competency
- The gap between training (and developing a certified program) and the impact training has on safety
- The impact of 'online' training (both during the academy and on the job) on quality of service (compared to traditional fire academies)
- What would be the generational difference for online training (effectiveness for younger firefighters compared to older firefighters)?
- Overall assessment of online learning
- How do the number of hours required by each state impact effectiveness (is there a sweet spot for the number of hours)?
- Effectiveness of crew-based training - training people for what you want them to do
- How do we widely share information from one state or department to others in terms of effectiveness?
- The relationship between training effectiveness and firefighter safety
- The development of a rubric to assess operations and trainings (objective measures of success and failure)
- What information does Proboard IFSAC, National registry, NFPA, etc. need to incorporate new technologies regarding VR, online, flipped classroom methods as approved training methods
- Value of formal higher education (degrees for officers) as well as continuing education/recertification
- Incident command training and integrating it in some virtual reality training

What discipline(s) of Research should be engaged?
- EMS/Military programs which use virtual reality as a component of their training
- Kinesiology and functional fitness for physical training
- Higher education
- IT and database management - create the ability to use data from size up and calls to develop trainings around decision-making skills
- Psychology - occupational and human factors - why do we behave the way we do based on stress?
- Construction - working with the construction field to increase the quality of building construction training

What Public Policy/Social Science Inputs are needed?
- An annual national recertification for firefighters – standardization across the board
- Policies associated with training about 'what we don't know' as a result of LODD and injury report analyses
- National funding opportunities for immersive training (still considered progressive and expensive)
- Higher education – college credit for formalized training certifications

2021 Research Agenda Symposium
Facilitator Worksheet #2

Domain: Effective Operations

Question: How do we do the job effectively?

Topic: Tactics

What Data is needed?
Qualitative: how decisions making skills are developed and employed on the ground; documenting and describing what was done, what worked, what didn't work, etc., from a humanistic standpoint;

Quantitative: time points (water on fire, venting, etc.); interior vs. exterior tactical points (objective measures of making those decisions); measure of water and other tool use; various measures and sensor information based on different building sizes and makeup; see UL studies for other measures; flow metrics, hose selection.

Other (Specify):

What Technology is needed?
1. Is there a pumping 'black box' to grab data and time frame on the fire ground
2. Harnessing the digital footprint - what type of data is already being collected but not utilized
3. How do we conduct tactics research (funding, etc.)?
4. Physics-based modeling to help with funding - how does that transfer that data to instruction and turn it into knowledge
5. Sensor-based data can be used in calls and training (and not just with fires)
6. Body cameras on firefighters - that can also track CO, O2, body temperature, etc.
7. True 3D body tracking for firefighters
8. Comprehensive HUD for information presentation for firefighters
9. Effective tactics of fire suppression on 'odd' buildings (anything other than single-family residential homes)

Define what an "Effective Measure" would be for this Domain/Topic.
• The sweet spot for number of personnel compared to the workload on the call and what a city is willing to fund
• Transferability of data from UL studies to real-life application
• Success in controlling the fire with the minimum negative consequence - property loss, firefighter injury, etc.
• Response times and their relationship to time to water on fire
• Time from dispatch to a safety officer arrives on scene or RIT being set up

What type of Research is needed?
• What is best for fire ground tactics instead of what are we doing
• Historical trends regarding tactics - how have they changed, when did they change, and why did they change?
• What is the current state of best practices across the country?
• How has the simplification of training impacted the individual's ability to make quick decisions (think of the historical knowledge needed to pump 15 years ago compared today) - requiring a wider range of knowledge will allow for individuals to develop a larger playbook and flexibility of tactics
• In addition to the understanding of the 'what' and the 'how' there needs to be room for an understanding of the 'how much' (staffing, equipment, impact of various numbers of personnel on a call)
• What impact does having technology in general have on the department's ability to make decisions - how is it an advantage. On the flip side, how much technology provides too much information and leads to decision paralysis based on information overload.

- How well do the national standards (1710 and 1720) actually translate to local contexts for communities and coverage? (Especially regarding urban vs. rural, and wildland, etc.)
- How water applied in the structural environment works and what is most effective (without any bias towards any particular approach)
- What tactics are most effective in covering huge areas and being mobile regarding wildland firefighting tactics
- What training and tactics are necessary for wildland/urban interface - how to best meld the two services together
- Clarify the differences between urban firefighting and wildland firefighting in the WUI environment to address equipment, training, tactics, etc. that are in the WUI environment
- Biometrics effects regarding various personnel levels based on the amount of work firefighters have to do. Personnel numbers impact on attack effectiveness also greatly impacts energy output on the firefighters themselves.
- What are common elements of the specialized group of fires (nonfamily structural contexts)?
- Safety and risk factors of various crew sizes inside an IDLH (2 or 3 or 4 person crews - working together, not splitting)
- Look at near misses in regard to safety issues
- Does two-in/two-out actually increase firefighter safety?
- Cost/benefits of various scenarios and tactics (based on equipment, apparatus, and personnel needed)
- What type of alternative tactics and support vehicles can be utilized (motorcycles, drones, etc.) (take a look at how various countries are tackling fires)
- Actual effectiveness of RIT (look at stats regarding who rescued the mayday firefighters)
- Should we be building our system to respond to the exceptional situation that rarely occurs or to manage the frequent occurrences with the capacity to adapt to the exceptional?
- How does shift schedule, sleep deprivation impact firefighter health and fireground effectiveness?
- How can we better understand, utilize, and clean up after the use of foam? When is it appropriate? Is it still appropriate? (Class B foams are being replaced and cause environmental issues)
- Exploring education/training/technology toward emerging issues: violence, riots, mass shootings, etc.

What discipline(s) of Research should be engaged?
- Engineering and building construction
- Psychology - how the brain works in stressful situations; how decisions are made; etc.
- Imagining technology - body cameras for firefighters
- Psychology - enacting change to tactics at the line level and pushback from cultures regarding change
- Fire dynamics
- Data science - collection, storing, and utilizing the data points. (Digitizing of paper records and previous studies)
- Economics - feasibility of new tactics and equipment needed based on the size and context of the fire department
- Media impact - social media - citizens with phones recording before and as firefighters get to work (Virtual Operation Support Teams)

What Public Policy/Social Science Inputs are needed?
- Ownership and legalities surrounding storing videos from body cameras (similar to issues associated with law enforcement) - how would those videos be shared with researchers as data collection?
- In general, privacy issues regarding data accessibility for researchers from tools that are already collecting data
- National dissemination of research - making the information and conclusion for the research accessible to all departments, not just departments known for making data-driven decisions
- Field standards - NFPA 1710 and 1720 - what is feasible based on the geographical location and context
- Ensuring volunteer departments are able to benefit from the data being collected and utilized by larger departments who have people who can read, understand, and implement data-driven decisions

2021 Research Agenda Symposium
Facilitator Worksheet #3

Domain: Effective Operations

Question: How do we do the job effectively?

Topic: Tools, Equipment, Apparatus ("Apparatus: These recommendations are for emergency vehicles or aircraft." "Tools and Equipment: These recommendations support improvements to the tangible resources used by firefighters.")

What Data is needed?
Qualitative: real-life application of technology for firefighters; behavioral factors regarding the use of tools and apparatus by firefighters; how we use the 'thing' (tools, equipment, apparatus).

Quantitative: what the is the 'thing' and all of its capabilities; the weight of tool; cost of tool; durability.

Other (Specify): where is the field leading in general – what types of tools and technology will reduce the reliance on human effort and reduce our exposure to toxic environments (aerial robotics; terrestrial robotics; submersible robotics; etc.)

What Technology is needed?
1. Drones (cost vs. benefits; durability; complications with airspace; etc.)
2. Revisit the fundamentals – hose clamps, hose materials, etc. (efficiency and effectiveness)
3. Air attack resources and improved delivery of water/retardant
4. Delivery of heavy equipment/supplies/water etc.
5. Improved technology for safe/efficient evacuations of communities
6. Sensory technology – apparatus rollover prevention
7. Standard car technology that would allow fire apparatus to communicate with cars ('you are approaching an emergency scene, please slow down) instead of relying on lights and sirens
8. Electric fire trucks/ambulances
9. Improved sensor/management technology for assessing the gas phase hazards – especially for off-gassing
10. Standard airbags and rollover protection for apparatus (instead of it being an option)
11. Improved materials in apparatus to help reduce exposures (clean cab concepts)
12. The ability for technology to talk to each other (MDTs, SCBA, Radios, etc.) (how they interface and their reliability)
13. Open data standard for fireground device communication, so any device can communicate independent of the manufacturer
14. Air quality inside cabs when it's not possible to doff gear before riding in the cab
15. Universal communication (FirstNet) to handle bandwidth during large scale emergencies

Define what an "Effective Measure" would be for this Domain/Topic.
- What constitutes 'affordability'?
- Identify the types of information we need for the various operation positions on the fire ground
- Metrics that demonstrate improved attack effectiveness (initial and extended)
- Reduced exposure risk
- Cost/benefit analysis of investing the money
- Operation and maintenance costs
- Success = technology works reliably and effectively to increase the safety and effectiveness of the fireground
- Cost effectiveness and functional effectiveness of equipment
- Attitudes/behaviors influencing the effective use of available tools/equipment

What type of Research is needed?
- Fire service tools are changing from gas-powered or hydraulic powered to battery-powered ---for example - does this cause any new risks with respect to having LI ION batteries in Chain saws - research needed on batteries drop tests, temperature extremes due to weather, fire environment exposures. Several significant building fires started in battery charging areas. Likely cause – damaged battery stops working, user puts "dead" battery in charger leading to fire.
- Fire hose has changed from natural materials – cotton and rubber to combinations of thermoplastics – recently there have been changes made to the hose standard to include a radiant heat test, but recently there was a serious injury to two FFs in Iowa potentially due to a cold weather (-15 F) burst. It seems that a more comprehensive look at the operating ranges may be needed.
- Re-examine Thermal Imagers - NFPA has a standard but allows manufacturers to have a "non-standard" operations mode. Which is likely the mode that most FFs use. Also, it has been demonstrated to some degree that there are common usage cases where the displayed temperature shown can be significantly cooler than the actual temperature of the smoke. Research is needed here.
- Effectiveness of lights and sirens – are we causing accidents on our way to accidents
- Benefits of electric apparatus and tools – for the health of the firefighters, cost, durability, fossil fuel reliability, etc.
- The impact of diesel exhaust on firefighters and scenes (health vs. benefit of electric energy etc.)
- Protection of vehicles in burn overs – improved protection but also improved materials and design (hot plastics can melt, and off-gassing can occur)
- Health outcomes regarding the clean cab concept – there is very little (if any) research to support this concept
- Effectiveness of 'cancer liners' being placed in the PPE
- Effectiveness (color, quantity, size, pattern) of chevron stripping on apparatus (related to conspicuity of apparatus and lighting are significant concerns)
- Overall apparatus design and construction today (what role does social pressure and pride have on apparatus choice?)
- Ergonomics in general regarding the use of tools, equipment
- Autonomous vehicles – self-driving cars and the relationship played with fire apparatus that park where self-driving cars don't expect cars to be
- Effectiveness of air filtration in caps and in ambulances

What discipline(s) of Research should be engaged?
- Training regarding use and care of tools – adopt the Marine mantra "this is my rifle" to fully understand and utilize the tools
- Manufacturing and marketing – affordability – the bottom line will always be cost
- Training and education – how to fully utilize 'complicated' technology so that it is easily digestible by the chief and company officers
- Construction and manufacturing of buildings – how buildings are being built may impact the equipment needed to fight fires given the new technologies associated with access, solar energy, etc.
- Ergonomics
- Engineering
- Chemistry
- Material sciences
- Sensor development
- Aeronautics
- Higher education
- Integrated advanced traffic control systems – cities, counties, streets

What Public Policy/Social Science Inputs are needed?
- Policies regarding the use of tools, equipment, and apparatus
- Standardization of data convention/form/format among fire service tools/equipment/apparatus
- Laws in cities, counties, streets regarding traffic control devices for lighting/intersections
- Development regarding NFPA standards – important for grant eligibility for small departments
- Building systems information being available to incident command to better understand what's happening inside the building – perhaps code and regulations related

2021 Research Agenda Symposium
Facilitator Worksheet #4

Domain: Effective Operations

Question: How do we do the job effectively?

Topic: Personal Protective Equipment (defined as anything you wear on you for protection: coat, pants, helmet, gloves, hood, SCBA)

What Data is needed?
Qualitative: the types of calls when PPE is being used worn (structure fires, technical rescues, MVCs, etc.); different sizing and styles for women; observation of PPE in real-life contexts and how firefighters are using the gear.

Quantitative: hard numbers on contamination risk (and various scales of contamination); the types of calls when PPE is being used worn (including various helmets, boots, bunker, etc. for specific types of calls); different sizing and styles for women; the weight of gear when worn both as individual pieces and as an ensemble as a whole; carbon monoxide exposure; data on thermal conditions (limited and over 60 years old).

Other (Specify): the assumptions on which PPE is developed – factors dated back 45 years – how do they relate to modern fires and firefighting; feedback from firefighters regarding new ideas – such as various layering gear – the likelihood and ease of having multiple sets of gears for various calls

What Technology is needed?
1. Material developments (weight, strength, etc.)
2. Testing technologies (re-evaluating TPP; re-evaluate the performance requirements and standards on the material level; need more garment and assemble level assessments; innovative things in exoskeleton (robotics simulation))
3. Systems-level testing – testing the whole ensemble rather than considering various combinations of usage
4. Respiratory protection – especially WUI/wildland
5. Rapid decontamination for skin, PPE
6. Dermal protection/particle barriers, smoke/soot protection
7. Hydration – especially cold/iced hydration (wildland/WUI PPE)
8. Wildland/WUI packs/web gear (specifically how it works with other equipment)
9. Hazmat
10. Black boxes – information collected via the SCBA
11. Post-fire breathalyzer for a breakdown of gas levels in blood levels
12. Comfort and ergonomics lead to correct use and effective firefighting
13. What technology is necessary to complete these tasks: measuring thermal heats; need technology for larger material pieces such as full coat with human skin on the other side; there is a lot of small-scale exposure which may cause issues when generalized to full-size gear; what protection level that gear provides while controlling for off-gassing of the PPE itself;
14. Dog tags and worn sensors against skin to track exposure to various chemicals
15. Longer duration SCBA (SCBA being worn by pump operators; remaining on-air while going through decon on scene; reduce needed space on apparatus for additional bottles)
16. GPS devices/technology located on SCBA in live time and broadcast the information
17. Integrated technology to allow for all PPE technologies to talk to each other and to command

Define what an "Effective Measure" would be for this Domain/Topic.
- Data that firefighters/chiefs can understand and use
- Reduced exposure – dermal and smoke
- Reduction of cardiac/stroke events, heat-related issues, etc.
- Rates and reduction of cancer

- Improved hydration/reduction of dehydration
- Reduced weight/load of gear
- Based on contamination on a number of levels, how well does the PPE protect the firefighters
- The overall effectiveness of what we're wearing

What type of Research is needed?
- Different layers for different jobs (practical implantation issues; what protection may be sacrificed, etc.)
- Effectiveness of NFPA standards regarding contamination measures for various sized departments
- Updated measures on thermal conditions – improved knowledge of burn causation
- What type of cross-contamination occurs when structure PPE is worn to various types of calls that are not fire-related
- The balance between thermal protection and breathability (increased breathability leads to reduced dehydration and heat stress but may lead to a loss of thermal protection – where is the sweet spot)
- The difference between male and female fit, sizing, and design
- The impact of ill-fitting PPE on female firefighters
- Individual and institutional resistance/acceptance to change (especially with PPE)
- Compliance/adherence to policies/regulations
- Linking changes in PPE technology to key metrics (injury rates, etc.).
- Improved temporal studies and longitudinal studies
- Tracking results of incremental and major changes in PPE
- Meta-analyses on major topic areas (cancer rates and dermal exposures, etc.) The intersection between PPE and operational tactics
- Total ensemble and the variance in TPP of each piece
- The impact of PPE on the functionality of each piece and the ensemble as a real-world world application of PPE (limited visibility, mobility, dexterity, etc.)
- General thermal stress on the individual – convection heat transfer through PPE
- Cleaning methods and contamination
- Proactive issues regarding contamination – how do we keep the gear from getting dirty to begin with?
- Testing PPE for roadway incidents (may compare to road workers)
- Resistance to changes in PPE care and cleaning
- How clean is clean? How dirty is dirty?

What discipline(s) of Research should be engaged?
- A research depository of multi-disciplinary work regarding the fire service and PPE
- Materials and textiles (textile scientist)
- Sports physiology, kinesiology;
- Biomechanics
- Marketing and manufacturing
- Economics for fire departments and the service in general (affordability)
- Education (budget managers – cities, districts, decision managers), training, outreach, public relations to inform the general public regarding the fire service and its PPE needs
- Education piece regarding the appropriate and safe use of PPE (including on the fireground)
- Public policy, regulation, legislation, lobbying, etc.
- Technology – wearables, sensor outputs, data management, open but secure data standards to ensure utilization of data
- Anthropomorphics
- Design (textile and apparel) - recognize the difference between sizing and design (pattern making)
- HazMat response teams (specialized fields)

What Public Policy/Social Science Inputs are needed?
- Operational based issues of PPE and advancements of PPE
- Updates to field standards regarding contamination levels and various forms of contamination
- Cleaning protocols and procedures for all sizes of departments
- Outreach that shows the value-added of PPE to everyone, including the larger community
- Economic impacts of PPE advancements – the impact on the budget and the role of decision-makers

2021 Research Agenda Symposium
Facilitator Worksheet #5

Domain: Effective Operations

Question: How do we do the job effectively?

Topic: Community Risk Reduction

What Data is needed?
Qualitative:
What does the public know and understand?

Quantitative:
Outcome measures (success, prevention, etc.) of pub ed programs; numbers of hoarding fires; retention of information (start with school-aged groups and move to adulthood - longitudinal)

Other (Specify):
What are the risks of each community? are there specific risks some neighborhoods face that are less essential for others?

What Technology is needed?
1. What is needed to reach people? What form of social media is being used at the moment for specific demographics?
2. ARC GIS Tapestry
3. Software or people to address language barriers for various international neighborhoods to ensure information is shared and understood
4. Social media (work with influencers to hit large groups)
5. Development in smoke alarms and sprinklers

Define what an "Effective Measure" would be for this Domain/Topic.
- How many fires have been prevented as a result of prevention week, school week, PSAs regarding smoke alarms, etc.?
- Retention of information regarding risk reduction throughout the citizen's life (from school age to adulthood)
- Information reaching a wide audience (and specific age groups are targeted with issues pertaining to that age group)
- An ability for several organizations to work with the fire service to address risk issues in the community

What type of Research is needed?
- Dissemination of pub ed information - what does the citizen understand and know regarding fire safety?
- How can we better get messages and new information out to the public (and consider various environments and socio-economic levels)
- How does hoarding affect fire operations?
- What are the comprehensive risks the fire service needs to reduce? (not just fires, what else are we tasked with?)
- How can we address risk issues from a proactive point of view (handing out smoke alarms before a fire happens instead of after)
- For cities that have had a significant reduction in fire-related deaths (civilians and firefighters), what have they done well?
- Is there a better smoke alarm or residential sprinkler than what's on the market?
- What are various measures of success pertaining to CRR?
- Look at life loss reduction and the number of fires over time compared to building codes and CRR environment.
- Various success of code enforcement based on cities (who does it well and what works for them)
- History of various fields as they get safer and how they impact the fire service and communities (roadway incidents, automobile regulation, building codes, etc.)

- Secondary accidents on roadways and the role of fire apparatus in causing secondary accidents
- Defensible space, building materials - what type of direct effects do they have on regarding WUI environments

What discipline(s) of Research should be engaged?

- International fire services - what do other countries do regarding CRR, and how can we implement some of their concepts
- Non-fire service partnerships in communities to address risks - retirement homes, etc.
- Social media to help spread information and risk reduction information (work with influencers)
- Public health programs in colleges to collect risk-related data and help the community (college students would be valuable in reaching younger demographics)
- Real estate - what information can be shared with homebuyers through real estate agents
- Hospitals - information that can be shared with new parents
- Community organization that would work on the enforcement side of codes and laws
- Automobile service - the impact of roadway incidents in the community and its part of the fire service's responsibility to ensure safety on the roadways as well
- Economists
- Statisticians; computer scientists; data scientists
- Communication experts;
- Psychology; sociology
- WUI: forestry; land management planners
- Meteorologists
- Local school districts - both to spread information and elicit buy-in and assistance from the community
- Insurance industry

What Public Policy/Social Science Inputs are needed?

- Engage the community - go out and talk to the people we are serving and ask them how we can best reach them, how they best receive messages, and how we can help
- Building codes - continue to make structures safer
- Legislature lobbying in general for state and local codes, including building codes

2021 Research Agenda Symposium
Facilitator Worksheet #6

Domain: Effective Operations

Question: How do we do the job effectively?

Topic: Other

What Data is needed? *(Qualitative, Quantitative, Other, specify)*

What Technology is needed?
No answer provided

Define what an "Effective Measure" would be for this Domain/Topic
No answer was provided

What type of Research is needed?
- The effect of a fire station on community property values (fire station location)
- Diesel exhaust in fire stations (what is the best way to get rid of the exhaust)
- Shared air in a fire station - sleep quarters and community spread viruses (Covid-related)
- Most effective ways to clean SCBAs
- Behavioral health and fire station design - having a positive effect on behavior health based on lighting, acoustics, color schemes, and interior design
- Comparison rates of multi-story stations based on the use of fire poles
- Effectiveness of built-in training props into fire stations and the use of them
- Open dorm rooms vs. individual rooms (same with common bathrooms compared to individual bathrooms) and the benefits and disadvantage
- Culture of fire extinguishment versus the culture of safety
- The impact of formal higher education in the fire service
- Tactics and responses to battery fires and flammable refrigerants (for solar panels as well)
- Examine the need for continuing education and/or officers, trainers, chiefs
- Renewable and emerging energy technologies

What discipline(s) of Research should be engaged?
- Real estate/city assessors (property values based on fire station location)

What Public Policy/Social Science Inputs are needed?
No answer provided

APPENDIX E:
DOMAIN 3 WORK GROUP WORKSHEETS

Worksheets are provided with minimal edits for informational purposes for potential researchers.

2021 Research Agenda Symposium
Facilitator Worksheet #1

Domain: Health and Safety Work Group Domain #3

Question: *How do we take care of people and encourage them to take care of themselves?*

Topics Covered: Health, Wellness, Injury Prevention, Fitness, Occupational Disease, and Medical Issues

What Data is needed? *(Qualitative, Quantitative, Other, specify)*
- Relationship between firefighting and injury rates/types
- Define FF-specific fitness and nutrition requirements and note they are different from general population guidelines
- Examination of tattooed skin on cooling (thermodynamics)

What Technology is needed?
- Information Dissemination/Centralized data dissemination resource
- Augmented/virtual reality training to reduce exposures
- Wearables
  - Sleep monitoring
  - Fatigue
  - Heart rate
- Assessment tools
  - How to measure fatigue (apps?)
  - Behavioral Health Assessment/screening
  - Fitness assessments
    - Stress testing, VO2max testing, MET values, etc.
- VO2 (cardiorespiratory fitness) accuracy (submax vs. max)
- Data security/confidentiality
- Mood/threat detection algorithms
- Exposure (and other) health tracking
- Baseline (pre-injury) neurocognitive testing
- Telehealth (use and access)
- Saunas (efficacy)
- Passive sampling (personal exposure)
- How to adapt technology that already exists for use in the fire service
- Less invasive technology to eliminate/lessen more invasive measures

Define what an "Effective Measure" would be for this Domain/Topic.
- Use a commonly available tool such as the "Factors Affecting Clinician Well-Being and Resilience" model

What type of Research is needed?
- How to improve total worker (overall) health
- Centralized data warehouse/clearinghouse, a repository for data
  - Consolidate/combine data?
- Must show the endgame importance, the "so what"; we must develop a message of importance on information gathering and explain how/why the information will be protected (non-punitive) and what it will be used for (message not getting to individual firefighters)
- Effective Communication/Research & Data Dissemination
  - Create tool kits, unified messaging
  - Research on stigma piece (i.e., overweight FFs or behavioral health); rethink how we address and discuss these topics

- Unified Messaging
  - Perhaps a Work Group to bring together all national orgs to develop and disseminate a unified message
  - Provide regional resources
  - Create a "best practices" document with low-cost and no-cost suggestions
- Implementation Science
- How to get firefighter buy-in? (i.e., adoption of health behavior; cognitive psychology)
- Fear of sharing health data
- Mental/Behavioral Health (depression, anxiety/worry, sleep, substance use, PTSD, suicide)
- Cancer
  - FF exposure (carcinogens, PPM, smoke, wildfire/brush smoke vs. structural)
  - Managing exposure risks
  - Reporting (personal + incident reporting)
  - Additionally, look at spouses, offspring
- Evaluation of cardiac risk
  - Risk stratification
  - Medical evaluations
  - Blood work, hypertension
  - ECG screening
- Behaviors outside of work (off shift activities)
- How to improve resilience
- Prevention factors (modifiable risk factors)
- Preventative medicine (i.e., baseline and annual physicals, etc.)
- Impact of firefighting on volunteer, wildland, WUI, fire investigators, fire trainers, etc.
- Effects of fire service culture on overall health
- Sleep habits/patterns and disorders
- Overexertion
- Nutrition
- Metabolic Syndrome
  - Hypertension, body fat, obesity, LVH, nutrition
- Injury Prevention/Risk Assessment
  - Do "injuries" include mental and physical injuries?
- PFAS – foam, gear
- Toxic chemicals
- Respiratory disease
- Social relationships/social support
- Reproductive Health
  - Pregnant FFs
    - Guidelines for FFs, departments, and physicians/health care providers
    - Policy (duty restrictions, return to work, breastfeeding)
  - Health risks for offspring
  - Infertility
- Women FFs Health
- The economic impact of poor health behaviors (i.e., low levels of fitness)
- Why departments do NOT have a wellness/fitness program (barriers to implementation)
- Physical fitness/ability testing – is CPAT the best model?
- Fatigue
  - How to measure
  - How it impacts performance
  - Mental vs. physical fatigue
  - Physiological monitoring, biochemistry
- Baseline fitness vs. ongoing/annual assessments
- Return to work protocol (NFPA 1582)
- Kidney health (especially rhabdomyolysis)

- Aging (esp. in volunteer fire service)
  - Musculoskeletal issues
  - Hearing impairment, visual changes (sensory impairments)
  - CVD Risk Factors
  - Weight gain
  - Cognitive impairment
  - Seizures
- Other chronic conditions associated with firefighting?
- Neurodegenerative Diseases (Parkinson's, dementia)
- Disparities in health status (i.e., minority health disparities)
- Genetic tendencies (importance of baseline health information)
- Nationwide surveillance system for firefighters?
- Occupational violence (internal and external – from within and outside those in the fire service)
  - Individual safety assessment
  - Harassment and assault; toxic/hostile work environment
  - Retaliation
  - LGBTQ issues
  - Bystander training
  - Protection from the community
- Workplace abandonment – loss of "fire family" after retirement or termination
- List/network of fire service-specific providers (ex: http://www.cffbh.org/)
- Mobility
  - Joint vulnerabilities and injury
  - Improperly fitting/restrictive gear
  - Mobility Assessments (DARI, Dartfish, FMS, goniometer, etc.)
- Biomarkers of effect (i.e., stress hormone, saliva, exhaled breath)
- Ambient environment (noise, heat, particulates, friction)
- Provider knowledge
- Testosterone (levels, supplementation, etc.)
- Measures of impairment (substance use including alcohol, marijuana, others)
  - Education for the FF on what these substances can mean for death benefits
- Presumption Laws (how they are linked to FF health, what testing is necessary to be covered by presumptive law)
- Testing/Assessment
  - Frequency
  - What testing is necessary and when (same for all FFs?)
  - Screening (ultrasounds)
- Culturally competent technicians/providers – how to find them
- Physician outreach (specific guidance for FFs)

What discipline(s) of Research should be engaged?
- Translation of research into practice/action
- Dissemination and Implementation (need a "common voice" sending out the same message)
- Organizational Psychology

What Public Policy/Social Science Inputs are needed?
- Effective measure/model for firefighter health
- Financial impact/importance of firefighter health research
- Engage Center for Public Safety Excellence (CPSE)
- Coordination of efforts among national organizations
- Edit NFPA standards in relation to the definition of "structural firefighting" as it is perhaps too broad

2021 Research Agenda Symposium
Facilitator Worksheet #2

Domain: Health and Safety Work Group Domain #3
Session #2, Thurs, February 18, 2021, 2:00-3:30 pm EST

Question: How do we take of people and encourage them to take care of themselves?

Topic: Wellness (Part II)

RECAP:

Define Wellness:
- As defined in NFPA 1500/1582/1583
- State of being in good health; holistically
- Act of practicing healthy habits on a daily basis to achieve better health outcomes
- From WFI: Wellness is a term that refers to an individual's state of mind as well as their physical state, balancing between health and physical, mental, emotional, and spiritual fitness
- Should encompass "comprehensive approach"
- The World Health Organization defines health as "not merely the absence of disease or infirmity, but a state of complete physical, mental, and social well-being." Wellness has been defined more as the action an individual takes to meet the above definition of health.
- Longevity component (on the job and post-retirement)
- Total Worker Health – work and home environments Include social and relational abilities; work-family balance
- Resilience
- Prevention factors – avoid unhealthy lifestyles; wellness is something proactive but should reflect on prevention factors
- 7 dimensions of wellness: physical, emotional, intellectual, social, spiritual, environmental, occupational
- Effects of brotherhood/culture on overall health

What Data is needed? *(Qualitative, Quantitative, Other, Specify)*
- What is the scope of the project? What is the goal? Qualitative, quantitative?
- Centralized data warehouse? Previously (at previous research meetings), we've discussed a centralized data warehouse. Given all the categories of data we are talking about, we need a repository of data. There are physical wellness measures; are we talking about preventative data, treatment data, psychological data? Think about a data warehouse, a large central data repository—federal government (NHANES, NHIS) as an example.
- Resources necessary (IFSI has access to resources); how to homogenize data to consolidate it.
- Technology component – what type of tech is needed?
- Blue Waters – Super Computers to handle and store the data. Need somewhere to store the data, machine learning to analyze the data. Infrastructure in place. NEED data scientists to see what is usable, what needs translation, and then how to make it accessible? I.e., a working group to decide who has access to this data – is it proprietary? HIPPA compliance?
- Dr. Fent – National FF Registry – had to create a system, data security, and privacy protocols; how to share data with external researchers. How to prove identity? NIST 800-63 Digital Identity Guidelines; SP 800-122 Guide to Protecting the Confidentiality of Personally Identifiable Information (PII)
- If you want to answer complex questions, you'll have to have a large participant database
- FSTAR - IAFC's site is open-source for research papers
- FSTAR; doesn't contain personal information; this is mostly published research. Collection point to allow fire service to read the research done/published specifically for the fire service. Designed as a repository for fire service research.
- Are we looking for access to data that comes from research studies, from firefighters, departments, or both?
- Difficulty getting firefighters to enter their data into a national registry
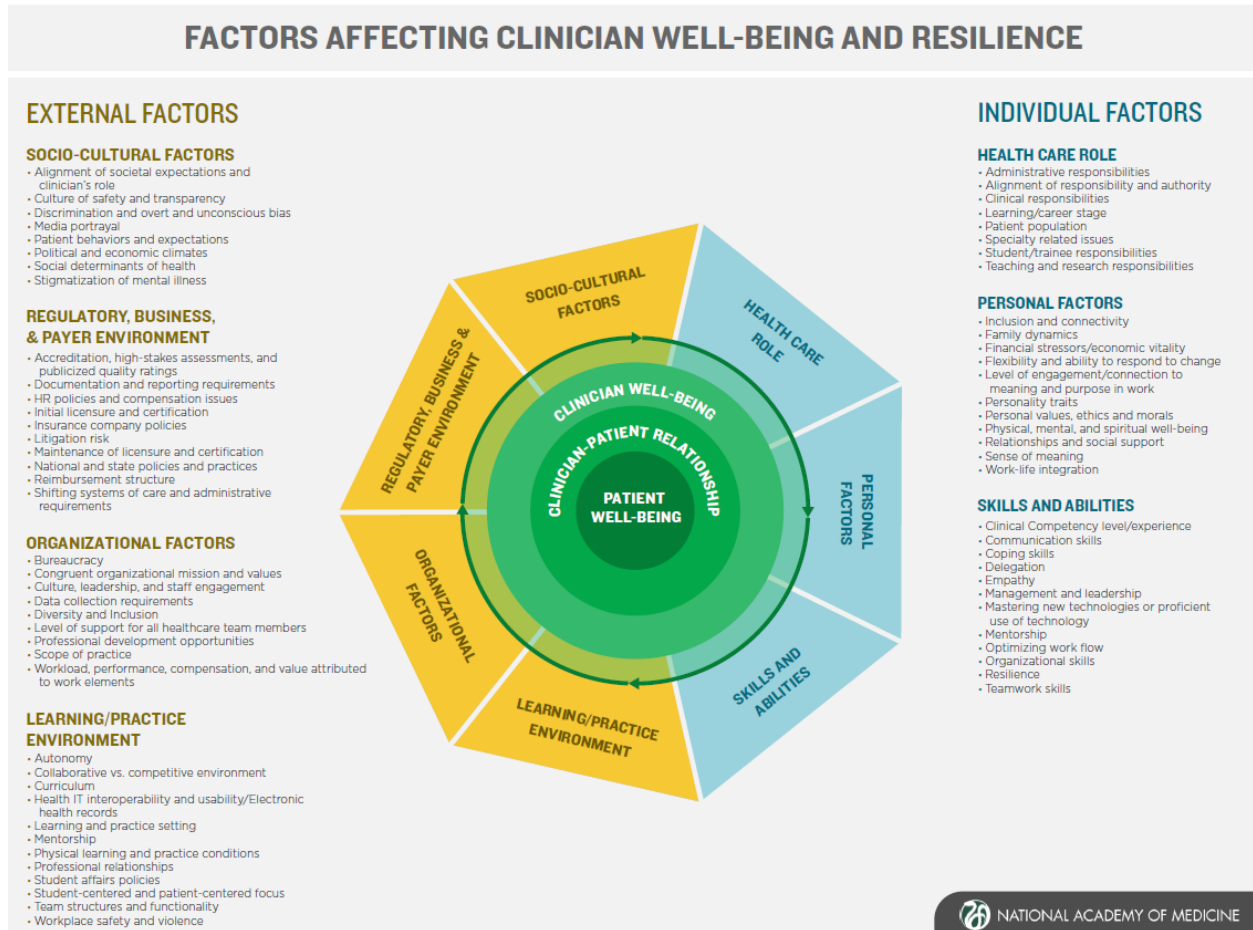
- FFRDC, it's the govt and private entities working together; how can we work together to merge resources. ASIAS (aviation) – balanced individual and industry data; protected under federal code of regulations including cancer databases, etc. This may work in the fire service—a bunch of databases that are combined together. Private citizens can do data searches. Individual information protected. Collaborative approach balances the interests of participants and researchers.
- Data Discussion:
  - One of the biggest hurdles is "garbage in, garbage out." For example, fire reporting. FFs do not provide enough detail when reporting. Reporting should be simple—secondly, security of the data. Because we have so many members, we could collect rich data, but the security of the data becomes an issue and a liability. Data protection is a huge cost. Last, this has been tried previously and then fades away. The more times we try this, the less effective it may be, and fewer people pay attention. Difficult to gain acceptance.
  - Certainly, questions around data security (will it be shared with my department, others?). Volunteers have full-time jobs also; how does that affect their volunteer work? Particularly in behavioral health and the impact on FFs. Much information is self-reported; can we get a better measure?
- Self-reported measures, there are already protections and federal guidelines in place (see aviation as a guide)
- Must show the endgame, the "so what"; why it's important to log it. We must develop a message on the importance of information gathering and explain why/how the information will be protected and what it will be used for. Reporting should be as simple as possible. How to get FF buy-in.
- Tough to gather information globally by individual FFs. Response bias. Who's filling out the survey vs. the rest of the fire service? Is this a representative sample? It may be better to get representative departments on board (whole dept data) to extrapolate to other departments.
- What is the most important thing to collect? Again, while it's an impressive response rate, there is certainly a response bias.
- It may be better to focus on whole departments and get their data. Get leaders in the fire service to tout the surveys and why it's important.
- Data is already out there that we don't know about/not all in one place
- Also – collect new survey data
- We may be better off collecting "good data" at the department level
- NDRI – bring researchers together to disseminate findings

What Technology is needed?
- Centralized data dissemination resource

Define what an "Effective Measure" would be for this Domain/Topic.
- Wellness definition complicated and complex
- Avoid re-inventing the wheel; there are models we can use
- Factors Affecting Clinician Well-Being and Resilience Model (External and Individual factors)

FACTORS AFFECTING CLINICIAN WELL-BEING AND RESILIENCE

EXTERNAL FACTORS

SOCIO-CULTURAL FACTORS
- Alignment of societal expectations and clinician's role
- Culture of safety and transparency
- Discrimination and overt and unconscious bias
- Media portrayal
- Patient behaviors and expectations
- Political and economic climates
- Social determinants of health
- Stigmatization of mental illness

REGULATORY, BUSINESS, & PAYER ENVIRONMENT
- Accreditation, high-stakes assessments, and publicized quality ratings
- Documentation and reporting requirements
- HR policies and compensation issues
- Initial licensure and certification
- Insurance company policies
- Litigation risk
- Maintenance of licensure and certification
- National and state policies and practices
- Reimbursement structure
- Shifting systems of care and administrative requirements

ORGANIZATIONAL FACTORS
- Bureaucracy
- Congruent organizational mission and values
- Culture, leadership, and staff engagement
- Data collection requirements
- Diversity and Inclusion
- Level of support for all healthcare team members
- Professional development opportunities
- Scope of practice
- Workload, performance, compensation, and value attributed to work elements

LEARNING/PRACTICE ENVIRONMENT
- Autonomy
- Collaborative vs. competitive environment
- Curriculum
- Health IT interoperability and usability/Electronic health records
- Learning and practice setting
- Mentorship
- Physical learning and practice conditions
- Professional relationships
- Student affairs policies
- Student-centered and patient-centered focus
- Team structures and functionality
- Workplace safety and violence

INDIVIDUAL FACTORS

HEALTH CARE ROLE
- Administrative responsibilities
- Alignment of responsibility and authority
- Clinical responsibilities
- Learning/career stage
- Patient population
- Specialty related issues
- Student/trainee responsibilities
- Teaching and research responsibilities

PERSONAL FACTORS
- Inclusion and connectivity
- Family dynamics
- Financial stressors/economic vitality
- Flexibility and ability to respond to change
- Level of engagement/connection to meaning and purpose in work
- Personality traits
- Personal values, ethics and morals
- Physical, mental, and spiritual well-being
- Relationships and social support
- Sense of meaning
- Work-life integration

SKILLS AND ABILITIES
- Clinical Competency level/experience
- Communication skills
- Coping skills
- Delegation
- Empathy
- Management and leadership
- Mastering new technologies or proficient use of technology
- Mentorship
- Optimizing work flow
- Organizational skills
- Resilience
- Teamwork skills

Central diagram: SOCIO-CULTURAL FACTORS · HEALTH CARE ROLE · REGULATORY, BUSINESS & PAYER ENVIRONMENT · PERSONAL FACTORS · ORGANIZATIONAL FACTORS · SKILLS AND ABILITIES · LEARNING/PRACTICE ENVIRONMENT · CLINICIAN WELL-BEING · CLINICIAN-PATIENT RELATIONSHIP · PATIENT WELL-BEING

NATIONAL ACADEMY OF MEDICINE

- Alberto suggests the National Academy of Science Well-Being conceptual model for clinicians (above); what can be measured from the NAS model?
- Discuss what can be measured easily (validated) and what is clinically relevant
- The difficulty is how to take what is measured and use it in a realistic/relevant way and disseminate the findings to the fire service
- Chat comments: Do we break down the measurements into quantitative and qualitative measurements and then look deeper into each?
  - The measure/manage approach will be something that will resonate better with the boots on the ground FFs and chiefs;
- Suggests a committee to discuss resource dissemination/clearing house
- Bring organizations to get to provide unified content and messaging
- Delivery model is a key factor – often overlooked by focusing too much on department leadership and city managers; may forget the boots on the ground FF
- What is valid, reliable information for the fire service?
  - It depends on rank (IAFC/IAFF); there are different communication models
- Hard to make change without buy-in; how to get buy-in?
- Group, coordinated effort for research translation
- FSTAR – the original mission was to translate/disseminate research for the FF
- USFA - https://www.usfa.fema.gov/operations/ergonomics/ch1-firefighter-injuries.html

What type of Research is needed?

- Sleep
- Mental Health
- Behavioral Health (depression, anxiety/worry, sleep, substance use, PTSD)
  - Behaviors outside of work
  - Resilience
- Nutrition
- Evaluation of cardiac risk
- Metabolic Syndrome
- Injury Prevention/risk assessment
- PFAS – foam, gear; examine toxins in general
- Cancer
- Hours worked and job exposure (injury, illness, cancer, etc.)
- Social relationships/social support
- Perceived workplace support and harassment
- Pregnant FFs
- Reproductive/offspring health risks
- Fitness
- Aging workforce
- Screening tools for mental/behavioral health
- Implementation Research
- Communication – effective messaging
- Wildland specific topics – work hygiene
  - Sleep hygiene
  - Shift structure
- Research is funded based on how it is federally categorized
- Andrea – remember it's not just structural FFs; remain broad-minded
  - Split personnel needed to look at multiple topic groups
  - Wildland, volunteer, wildland-urban interface, fire investigators, fire trainers, etc.
- Fire service would benefit from implementation science; strong need to translate research to application; this can be scaled to be applicable to multiple groups
- Augmented/virtual reality training to reduce exposure rate
- Focus on women FFs (See USFA document on women FFs: https://www.usfa.fema.gov/operations/ops_safety.html#women)

What discipline(s) of Research should be engaged?

- See above for a broad list

**What Public Policy/Social Science Inputs are needed?**

- Organizations working together to synthesize and disseminate research
- Need to focus on dissemination of results for actionable results

Additional Models Suggested:

TABLE 1.1 Dimensions of Wellness Indicators

Dimension	Description	Indicator
		Absent .... Present
Physical	Ability to carry out daily activities with vigor and relative ease	Unfit .... Fit
Emotional	Ability to understand feelings, accept limitations, and achieve stability	Miserable .... Content
Social	Ability to relate well to others within and outside the family unit	Disengaged .... Connected
Intellectual	Ability to learn and use information for personal development	Mindless .... Aware
Spiritual	Ability to find meaning and purpose in life and circumstances	Lost .... Secure
Occupational	Ability to find personal satisfaction and enrichment through work	Frustrated .... Fulfilled

ACSM's Complete Guide to Fitness & Health
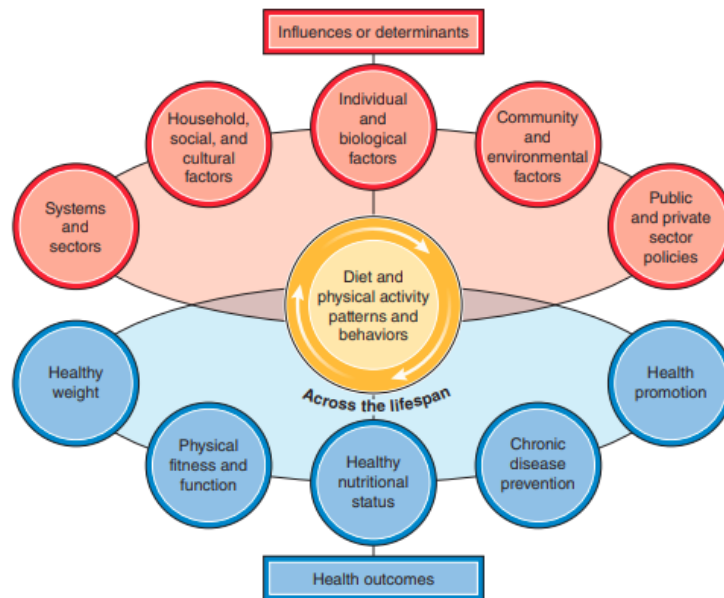
2021 Research Agenda Symposium
Facilitator Worksheet #3

Domain: Health and Safety Work Group Domain #3
Session #3, Fri, February 19, 2021, 2-3:30 pm EST

Question: How do we take of people and encourage them to take care of themselves?

Topic: Occupational Disease II

RECAP:

What Data is needed? *(Qualitative, Quantitative, Other - Specify)*

- Cardiovascular Disease (heart attacks, strokes)
- Cancer
- Sleep Disorders
- Aging-related disorders
- Exposures (carcinogens, PPM, smoke, wildfire/brush smoke vs. structural, etc.)
- Respiratory Disease
- Modifiable/Foundational risks/habits (including nutrition, sleep, fitness, physical activity, metabolic syndrome)
- Managing Exposure Risks
- NFPA standards and different types of FF equipment/ensembles (PPE, respiratory)
- Obesity
- Mental Health (suicide, depression, PTSD, impaired sleep)
- Neurodegenerative (Parkinson's, dementia)
- Birth Defects in Offspring
- Reproductive Health
- Wildland (Rhabdomyolysis, kidney disease)
- Noise-induced hearing loss (sensory impairment); additionally, aids like hearing aids being allowed in the fire service
- It would help to have a collective list of where the fire service ranks in terms of morbidity and mortality (what are top issues)

Suggestions via email:

- Tracking cardiac event survival (preventative testing vs. survivability)
- Testosterone levels (serum vs free/bioavailable)

Friday, February 19, 2021
Recap (see above)
Brief Intros for those that haven't attended previous sessions
Wellbeing Domain Discussion – built a subgroup to further discuss this issue

- Subcommittee members: Kepra Jack, Dan Kerrigan, Marc Kruse, Nick Perkins, Andrea Wilkinson, Tiffany Lipsey, and Kane Nixon

Continue with what data is needed?

- Cardiovascular Disease, Cancer moved to the top (importance)
- Sleep *Disorders* noted, not just "sleep."

What Technology is needed?
- Required annual physicals
- Wearables (i.e., app, watch, etc.)
  - Whoop band: https://www.whoop.com/
  - Physiologic status monitors
- Personal monitoring equipment (SMARTER study, physiologic status monitors)
- A central data reporting system
- Self-reporting app
- Passive sampling devices (personal exposure)
- How to adapt technology that already exists to the fire service
- How to interpret this data
- Non-invasive technologies to eliminate/lessen more invasive measures

Define what an "Effective Measure" would be for this Domain/Topic.
- Wearables
- Tracking across time

What type of Research is needed?

What discipline(s) of Research should be engaged?
- What wearables are acceptable in the fire service
- Data for best practices
- *Translational* Research (Dissemination)
- Clearing House (repository) for research is NECESSARY
  - FSTAR
- Monitoring/Evaluate items for effectiveness
- Tracking across time, part of the continuum
- Shift Schedule
- FF Education (ex: how to get them to see a primary care provider)
  - We're not connecting the research into practice
- Health overtime, long-term impacts
- Connect projects, connect the research dots
- Need more studies on translation and/or implementation science
- Barriers to implementing "best practices."
  - Financial barriers
- How to make the research important to the FIREFIGHTER
- Acknowledging the difference between education and fire service culture (research vs. practice)
- Wellness advocate within the department
- Organizational Psychology – how to connect research and individual behavior; culture/climate

What Public Policy/Social Science Inputs are needed?
- Translational/Dissemination IMPORTANT
  - Translation of research to providers/specialists
- How to engage the individual FIREFIGHTER; the importance of leveraging research for prevention

2021 Research Agenda Symposium
Facilitator Worksheet #4

Domain: Health and Safety Work Group Domain #3
Session #4, Monday, February 22, 2021, 2-3:30 EST

Question: How do we take care of people and encourage them to take care of themselves?

Topic: Health II

What Data is needed? *(Qualitative, Quantitative, Other - Specify)*
- Expand on education for firefighters (connect research and practice)
- Organizational Psychology; organizational culture/climate
- Translation of research into behavior change
    - Figure out ways to change climate/culture, engage FFs
    - FYI: USFA has a document regarding safety culture change:
      https://www.usfa.fema.gov/downloads/pdf/publications/fa_342.pdf
- Behavioral Health screening
- Sleep screening
- Provider knowledge – i.e., Physician's Guide
- Unified communication/messaging
- How to convince the return on investment is worth it?
- Dysrhythmias

Added from email correspondence:
- Testosterone (levels, supplementation, underlying issues)
    - Recent publication: https://onlinelibrary.wiley.com/doi/full/10.1111/andr.12860
    - Not firefighter specific but relevant: https://pubmed.ncbi.nlm.nih.gov/25044637/
- Cancer among spouses/offspring
- FF Cancer exposure (personal reporting coupled with incident reports)

What Technology is needed?
- Assessment tools (physical, medical, behavioral health)
- Behavioral Health Assessment/Screening
    - Front Line Behavioral Health: privacy is key;
    - In our sample of firefighters, those who screen positive for impaired sleep are more than 5x as likely to screen positive for depression (44.3% vs. 7.8%), almost 5x as likely to screen positive for an anxiety disorder (40.1% vs. 8.5%), more than twice as likely to screen positive for alcohol use disorder (23.6% vs. 10.6%) and almost 13x as likely to screen positive for post-traumatic stress (6.4% vs. 0.5%). Yes, impaired sleep is a symptom of each of these conditions, but the data is staggering
    - Surveys via cell phone (private)
    - Not punitive in nature; privacy; connect to professionals if needed
- Telehealth/access to providers

Continuing, Monday:
Recap
Discuss sub-committee for Health and Wellness Research Models Subcommittee: Kepra Jack, Dan Kerrigan, Marc Kruse, Nick Perkins, Andrea Wilkinson, Tiffany Lipsey, Kane Nixon, Eric Theel
*Brittany will email subcommittee for further discussion and availability for a call

Define what an "Effective Measure "would be for this Domain/Topic.
- Physicals
  - Clarify terminology: physical, really referring to medical evaluation (blood tests, heart ultrasounds, x-rays, behavioral health assessments)
- Metabolic syndrome processes – hypertension, body fat, obesity, LVH, nutrition
- Fitness assessments, stress testing, submax/max testing
  - Fitness testing - stress testing; performance
  - MET values
  - VO2 testing
- Medical stress testing as a diagnostic tool for future
- CPET (can provide both performance (VO2) and medical diagnostic info)
- *Initial* testing (baseline); initial physical and medical evaluation (patient history, testing, etc.)
- Do all measures need to be completed annually?
  - NFPA 1582
  - NFPA 1583
- Sleep habits/sleep pattern disorders
  - National Sleep Foundation has info on shift work disorder: https://www.sleepfoundation.org/
  - Evaluation of diseases/illnesses related to sleep (sleep apnea)
- Risk stratification
- Medical evaluations
  - Blood work
  - Hypertension
- Seattle criteria: https://bjsm.bmj.com/content/47/3/122
- Behavioral Health (including sleep, mental health disorders, physical activity habits, substance use, etc. and links to adverse health outcomes like cancer)
- ECG screening
- USFA Effects of Sleep Deprivation study with IAFC, Oregon Health, and Science: https://www.iafc.org/topics-and-tools/resources/resource/sleep-deprivation
- A list of all FEMA funded abstracts so we can see what they have funded in the past: Sleep and cardiovascular health-annual meeting https://collectedmed.com/index.php/article/article/course_preview/article/85/8335/683
- Measures of impairment (substance use including alcohol, marijuana, others)

What type of Research is needed?
What discipline(s) of Research should be engaged?
- Examine annual vs. periodic testing
- Presumption laws and testing (how are they linked; what testing is necessary to be covered by presumptive law)
- Determine when testing is necessary (should we be doing testing earlier in a firefighter's career or more frequently?)
- Specific research we can point to, what's missing?
- Evaluations we use to assess this population (are "normal" or "athlete" guidelines acceptable for firefighters?)
- Guidelines/norms specifically for firefighters?
- Screening (i.e., ultrasound)
- Sleep deprivation
- Sleep and cardiovascular health- annual meeting
  https://collectedmed.com/index.php/article/article/course_preview/article/85/8335/683
- Shiftwork – examine the impact of shift schedule on health/sleep hygiene
- Wildland differences (i.e., shiftwork, etc.)

- Tools that will assist firefighters and not disrupting work patterns
- Substance use
  - Alcohol, Marijuana use, opiate use, tobacco use
  - How do you measure impairment?
  - Use/showing up in tox screen can impact LODD benefits
  - Measures of impairment
  - IAFF has smoking cessation resources: https://www.iaff.org/fts/smoking-cessation/resources/
- Off-duty behaviors
- Educational pieces – how to share this information with firefighters
- What programs can FD's implement to reduce the use of harmful substances
  - IAFF: Quitting Your Way program
  - NVFC: Put It Out
- Behavioral Health and medical health issues
- Nutrition
  - Supplements, caffeine, energy drinks, pre-workout
- Saunas (sweating out toxins)

What Public Policy/Social Science Inputs are needed?

- Telehealth
- Culturally competent technicians/providers – how to find them
  - NVFC launched a behavioral health professionals directory
  - https://www.nvfc.org/nvfc-releases-behavioral-healthcare-provider-directory-for-emergency-responders/
- Physician outreach (specific guidance for FFs)

*Note on worksite wellness: RAND Study - 2013
Infographic: https://www.rand.org/pubs/infographics/IG101.html
Full Report: https://www.rand.org/pubs/research_reports/RR254.html

Here is information on potential USFA studies and reports of interest:

Study of Occupational Violence with USFA, IAFF, and Drexel
University: https://www.usfa.fema.gov/downloads/pdf/publications/mitigation_of_occupational_violence.pdf

Study on Emerging Health and Safety Issues Among Women in the Fire Service:
https://www.usfa.fema.gov/downloads/pdf/publications/mitigation_of_occupational_violence.pdf

Pandemic Preparedness Study: https://www.usfa.fema.gov/operations/ops_emergencies.html and
Information for First Responders on Maintaining Operational Capabilities During a Pandemic.

2021 Research Agenda Symposium
Facilitator Worksheet #5

Domain: Health and Safety Work Group Domain #3
Session #5, Tuesday, February 23, 2021, 4-5:30 EST

Question: How do we take care of people and encourage them to take care of themselves?

Topic: Fitness

What Data is needed? *(Qualitative, Quantitative, Other, specify)*
- Relationship between fitness and injury rates
- Define FF fitness and nutrition requirements and note they are DIFFERENT from ordinary citizens
- Research that describes the fitness/nutrition guidelines specific for firefighters (like FSTAR guide for physicians)
    - Include the economic impact of low levels of fitness
- What are they doing (fitness, nutrition) off duty?
- The economic impact of low levels of fitness among FFs
- Fitness for longevity vs. fitness for job performance (what is optimal?)
- Dr. Kuehl examined the benefits of WFI vs. no WFI
- Why don't departments implement WFI's/wellness programs?
- New hire testing – is CPAT the best model?
- Impact of wearing gear during VO2 testing; doing the test on air; is it best to do the test in gear? (replicate real scenarios)
- Examination of tattooed skin on cooling

What Technology is needed?
- Wearables
- How to measure fatigue
- VO2 testing (accurately measured) to measure TRUE fitness level vs. estimated
    - Accuracy of peak VO2 assessments in career firefighters: https://occup-med.biomedcentral.com/articles/10.1186/1745-6673-6-25
- App to measure fatigue?

Define what an "Effective Measure" would be for this Domain/Topic.
- What already exists?
    - IAFF/IAFC Joint Labor Management Wellness-Fitness Initiative (WFI): https://www.iaff.org/wellness-fitness/
    - https://www.iaff.org/nutrition/
- NIOSH Total Worker Health Model
- Obesity study from NVFC: https://www.nvfc.org/wp-content/uploads/2015/09/Obesity_Study.pdf

What type of Research is needed?
- Psychomotor Vigilance Test – look at correlation to fatigue
- How to get FFs to be more active (link physical activity to reductions in cancer risk, heart disease, etc.) – cognitive psychology/behavioral research
- Link fitness to other health parameters (modifiable risk factors such as HTN, diabetes, obesity, CHD, high cholesterol, etc.)
    - Or better yet, educate FFs regarding what is already known
- Link between fitness and injury reduction

- Physical activity's relationship with cancer
  - Diet/nutrition (ACS recently changed prevention guidelines to highlight diet and physical activity https://www.cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention/guidelines.html
- Examine benefits of an overall wellness/fitness program compared to just exercise
- Baseline fitness examinations as well as ongoing/annual fitness exams
- Return to work protocol (add to 1582?)
- Fitness on duty (management buy-in to allow for on-duty exercise)
- "Clearing House" for fire service research; strategic planning by multiple major organizations to create a common message with the same evidence-based guidance
- Nutritional advice from a registered dietician
- How to get the information we have out to the fire service?

What discipline(s) of Research should be engaged?
- Dissemination/Education of current research results that translate to the fire service
- Cognitive Psychology – how to get FFs engaged in increased fitness to reduce injuries and enhance performance

What Public Policy/Social Science Inputs are needed?
- Coordination of efforts among national organizations
- Impacting public policy to allow fitness on-duty
- Share information not only with fire departments and department leadership but also with county managers, etc. to change policy
  - ICMA
  - City/county managers
  - US Conference of Mayors
  - National League of Cities: https://www.nlc.org/program/risk-information-sharing-consortium-risc/
  - National Association of Towns and Townships
- Maybe instead of a "fitness" program, call it a "risk aversion" or "risk reduction" program
  - Call it "Tactical Athlete Injury Prevention Program" to include Fire, Police, EMS
- Policy notice: cognizant of ACLU issues? Hiring practices must remain legal; how to hire the "best" FF for the job while still hiring "anyone who can do the job."
- Impacting policy to discuss the tests NFPA standards suggest for VO2max testing. For example, research shows MAXIMAL testing (with measured oxygen consumption) is ideal vs. submaximal testing
- What does NFPA 1500 consist of, and how does it need to be updated

2021 Research Agenda Symposium:
Facilitator Worksheet #6

Domain: Health and Safety Work Group Domain #3
Session #5, Tuesday, February 23, 2021, 4-5:30 EST

Question: How do we take care of people and encourage them to take care of themselves?

Topic: Injury Prevention

What Data is needed? *(Qualitative, Quantitative, Other, Specify)*
- Examine frequency and Type (physical injuries)
- Examine departments with trainers, athletic trainers and compare to departments without those and compare injury rates
- How to define injury? Physical, mental? Include deaths? Fatal vs. non-fatal?
- USFA Injury study: https://www.usfa.fema.gov/downloads/pdf/publications/fa_342.pdf
- Mortality Data
- Hospital inpatient discharge data
- ER visits
- Health interview data
- Health and nutrition examination data
- Medical Exposures on EMS calls; infection control, exposures
- USFA about to release EMS safety study (released later this year)
- Interventions/mitigation strategies
- How does the presence or absence of a fitness program and fitness education and impact injury rates/frequency?
- Musculoskeletal injuries (medical vs. fire vs. no alarm; i.e., where do injuries occur)
  - Baseline and annual (to track overtime)
- Psychological injuries (psychology, trauma)
- Mobility, joint vulnerability, and injuries (mobility in gear, ability to move freely)
  - DARI 3D Motion Lab for assessment
  - FMS
  - Chris Fleming to provide info on what he's doing with mobility/data capture
- Injuries related to improperly fitting/restrictive gear
- Sleep data
- Biomarkers of effect (i.e., stress hormones)
- Injury Prevention (focus on how to PREVENT injuries)
- Standardized data collection piece; how to link data across studies to share standardized information – this goes across all realms/topics

What Technology is needed?
- Risk Assessment tool
- Functional Movement Screen
  - Screen in gear? Getting in and out of the truck?
- Work movement assessment
  - When are we screening individuals? New hires? Annual for incumbents? Work tasks? Are these screens relevant for FFs?
- Is there a standard movement screen? How can we compare data nationally for firefighters?
- Environment/Ergonomics Assessment tools
  - Dartfish; exoskeleton programs (will map body to examine biomechanics)
  - ROM examination and risk stratification (but may not be practical)
  - Replicate with athletic trainer and goniometer (orthopedic screen)

- o Perhaps complete movement screen in PT clothes and in gear
  - o IF doing assessments, must know what the job requirements are; how do limitations affect job performance
  - o DARI movement system
- Translation/integration of tools and assessment information into practice
- Wearables
  - o Accelerometer
  - o Difficult to glean data due to the enormous amount of data post-processing
  - o How to make it fireground/firefighter acceptable?
  - o Physimax System
  - o Sleep monitoring
  - o Heart rate monitoring
  - o Fatigue
- Behavioral Health monitoring
- Body camera – to capture traumatic incidents
  - o Go Pro cameras
- Note that some technologies may not be appropriate to be worn by FFs all the time but rather used in studies so researchers can get information and help firefighters and departments change practices based on that data
- *Important to connect technology research with outcomes
- Baseline pre-injury concussion testing (lots of free computer-based neurocognitive testing)
- Physiological monitoring (PHASER); Examine what's already been done before reinventing the wheel: https://www.phaser.med.ucla.edu/

Define what an "Effective Measure" would be for this Domain/Topic.

- How to effectively measure fatigue (O2 sat, etc.)
  - o Mental vs. physical fatigue
  - o Self-report measures?
  - o Objective measures are important too
  - o Physiological monitoring; biochemistry markers to measure fatigue: https://www.phaser.med.ucla.edu/
  - o ATP monitoring https://www.berthold.com/en-us/bioanalytic/knowledge/glossary/atp-measurement/
  - o Reaction time; develop an app to be used almost like a game; see how your reaction time changes over a shift
  - o Specific issues for volunteer FFs
- Psychomotor Vigilance Test: https://link.springer.com/article/10.3758/BF03206404
- Biomarkers of effect (i.e., stress hormones, saliva, exhaled breath)

What type of Research is needed? What discipline(s) of Research should be engaged?

- Does technology actually reduce injury rates
- What's already been done? Don't reinvent the wheel but maybe improve upon what's already been done
- Examine PT's and ATs that work with FFs and what is improved when these professionals are included in the mix
- Ergonomics - seatbelt Research, gear/PPE, equipment, SCBA
  - o Different gear for different call types
- Flexibility Research – examining methods of increasing flexibility/mobility (yoga/stretching)
  - o Flexibility for reducing injury rates
  - o Start this training out early in a FF's career
  - o Range of Motion
- Examine ambient environment and its effect on injury (noise, heat, particulates, friction)
- Examine NFPA 1971 definition of "structural firefighting" and if we can wear different types of gear for different situations
- Fatigue Risk Management programs

What Public Policy/Social Science Inputs are needed?

- Examine NFPA standards as it relates to what gear we wear when (why do we wear structural gear for all activities?). "Structural firefighting" is extremely broad.

2021 Research Agenda Symposium
Facilitator Worksheet #7

Domain: Health and Safety Work Group Domain #3
Session #6, Thursday, February 25, 2021, 2-3:30 EST

For today:

Question: How do we take care of people and encourage them to take care of themselves?

Topic: Medical Issues

What Data is needed? (Qualitative, Quantitative, Other, specify)
- **Pregnancy** – dealt with differently in different places; physicians don't have consistent information/guidelines
  - Infertility measures (men and women)
  - How long should a pregnant female stay on duty? What limitations should exist?
  - Return to work
  - Breastfeeding/breast milk
- USFA Women FFs Report:
  https://www.usfa.fema.gov/downloads/pdf/publications/emerging_health_safety_issues_women_fire_service.pdf
- Kidney Health
  - Wildland FFs and rhabdomyolysis
  - Longitudinal studies; also look at acute instances of rhabdo
- **Overexertion, sleep, nutrition** (especially in wildland firefighters, volunteers)
- **Volunteer** issues similar to structural and wildland – cardiac, behavioral health, diabetes
- **Aging** firefighters (esp in volunteer fire service where avg age of FF = 50)
  - Musculoskeletal issues
  - Hearing Impairments
  - Visual changes (sensory impairments)
  - CVD Risk Factors
  - Weight gain
  - Cognitive Impairment
  - Seizures
- **Preventative Medicine**: baseline and annual physicals
- Occupational Health Surveillance System
  - What other chronic conditions may be elevated in FFs
  - May be chronic conditions not on our radar
  - Look at CODs for moving forward
  - Would benefit from an overall surveillance system; based on exposures (all) FFs face
  - Firefighters are wary of sharing their data
  - Central Repository for FF data would be helpful
  - Here's what Front Line is doing: They have over 1,000 FFs in their data pool.
    https://app.powerbi.com/view?r=eyJrIjoiZTc5NTBkZWEtYTQ0NC00MzY2LTg4NWYtZDlmMDEzOGJmOGNlIiwidCI6ImU
    xZDU2M2IzLTEzOTEtNGE1Mi04MjQ1LTYzNGU0N2E2YmQ5YyJ9&pageName=ReportSection290018f6d89d945793e0
- Disparities in Health Status
  - Hypertension (HTN) – different risks in different populations (minority populations, etc.)
- Genetic tendencies for certain cancers, diseases
  - Important to have a BASELINE for individuals
  - I.e., aware of BRAC2 gene or other things that may make the FF more susceptible to certain types of cancer
- How to present this information to a FF without information overload?
- What about a nationwide surveillance system/national database (i.e., NHANES for FFs)
- How to work with unions to reduce pushback

- Work with local hospitals/grants/etc. to get auto BP cuffs in the station (for example), so they can check BP daily and share info with their doctor. "Check your Mask, Check your BP" program
- Confidentiality - Important to have a statement like "this information will not be used against you" to help breakdown barriers to data collection
- **Occupational violence** – USFA & Drexel did a study on external (outside the firehouse) violence
  - Mitigation of Occupational Violence to Firefighters and EMS Responders https://www.usfa.fema.gov/downloads/pdf/publications/mitigation_of_occupational_violence.pdf
- Individual safety assessment
- Workplace Psychological Safety
  - Harassment and assault (internally); toxic/hostile work environment
  - Reports outside the chain of command (trust lacking; retaliation)
  - LGBTQ issues
  - Military, colleges/universities have had successful bystander intervention training
- Culture difference of impression of what is considered bullying/harassment
- **Workplace Abandonment**: Loss of "fire family": abandonment; retirement; termination, etc.

What Technology is needed?
- Technology that provides confidence in data security and confidentiality
- Tech – mood detection algorithms; facial and mood recognition software to detect FF mood
- Threat detection algorithms; law enforcement often uses threat detection algorithms. Reading body behaviors in patient care situations to protect personnel

What type of Research is needed?
What discipline(s) of Research should be engaged?
- Fear of sharing health data

What Public Policy/Social Science Inputs are needed?
- Pregnancy policy/issues need to be disseminated to fire departments, leadership, and physicians, so they are educated as to what a firefighter's job entails
- Break down a "report back" to give FFs usable information that isn't overwhelming but is informative
- Could certain data elements be a recommended practice in NFPA 1582? Suggested tracking certain measures/elements
- Buy-in from the top down
- Volunteer firefighters also do not have a central data repository
- Labor push back to certain data being collected, worried it would be used in a punitive way
- HR aspect to collecting firefighter data

What are we missing?
- NVFC: Has a list of behavioral health specialists
- There should be a class or information for providers to understand FF culture to better serve them
- Center for FF Behavioral Health: http://www.cffbh.org/

2021 Research Agenda Symposium
Wellness Subcommittee Notes

Domain: Wellness Subcommittee
Friday, February 26, 2021 10:00-11:00 EST

Facilitator: Kepra Jack

Attendees: Andrea Wilkinson, Hannah Kling, Tiffany Lipsey, Nick Perkins, Dan Kerrigan, Terry von Thaden, Bill Troup, Mark Kruse

Why are we here today?
- The Health and Safety Work Group (#3), during the Health Topic discussion last week, got stuck on effective methods for measuring health/wellness outcomes, specifically on Well-Being. Rather than re-invent the wheel, the Working group elected to form a sub-group that would discuss and explore existing models of well-being.
- Keep in mind not just career environment; remember wildland, volunteers, paid per call, etc. We need to think about the best way to get information to all groups. Remember spouses as well.

What is an effective measure of firefighter well-being?
- Increase wellness, but ultimately reduction of responder injury and death.
- Key measure of elective officials is cost-effectiveness
- There are foundational issues that apply to all FFs (careers, volunteer, wildland, etc.), then beyond that, more specific issues in those demographics. The information dissemination is a weak point - we need a "common voice" that all groups will get the same message, especially for the foundational health components, then more direct messaging for specific demographics. Effective measures include results of studies like WFI that prove reduction in costs, injuries, lost time, etc. The message is not getting out to all FFs.
- What is an effective modality?
  - There's great info out there (IE: WFI), but FFs don't know about it
  - We need to make it important to them
  - FF's need relevant info for them such as risk factors- what should they do to be better- it's not your FD's responsibility; it's yours or a shared responsibility
  - Governing officials want to know about the financial side
  - Can we use classes or online module training programs to get the message out to FFs? Especially for those in remote areas or those who can't attend conferences.

What type of Research is needed?
- There is a ton of research out there- it needs to get out in a digestible format ("snack-sized content")
- Create tool kits, identify regional providers that understand fire service needs, uniform basic level health and wellness messages, and focused messages for specific demographics
  - Create an org chart similar to what NFFF has for the EGH program; regional delivery approach using SMEs in each demographic area. This puts ownership into the task-work content around what is relevant for their area. Incident command structure- stay in your lane.
    - IE: Pennsylvania is a commonwealth, so they are very unique to their coverage model and have different municipal governmental ties
  - The representation to create the tool kits has been from all major associations so that consensus is gained on the messages being delivered, so we have large scale buy-in
  - Content of tool kit- gold standard research/ resources for all FF's then local/regional and specific materials for each (IE Wildland or geographically relevant materials)
    - Resilience measurement groups, tools- are you where you need to be?

- o Work Group to bring together all national orgs to get materials together – NVFS, IAFF, etc.- get a consistent message?
    - ▪ Train the trainer format? Application and implementation who would their resources be? Not just medical, but regional sponsors.
    - ▪ Town hall format
- o FFCSN- regionalized materials, but some groups said they couldn't implement suggestions. So best practices list was created- if you can't afford new things, here's a list of things you can do with no money. Create a best practice, low cost, no cost list
- o We need to be flexible with online and in-person content.
    - ▪ Some FDs feel strongly about some of the NFFF programs and prefer the in person delivery over online.
- o Get toolkit materials accredited and certified so that it can serve as continuing education hours for both EMS and fire training
- o Include telemedicine options
    - ▪ It tends to be a personal preference but has allowed for more couples counseling among FFs.
    - ▪ Know your audience, know the delivery method that would be best received.
- o Consider stigma piece (IE overweight FFs or behavioral health) as an extra barrier- need the right people who have the right knowledge to reach these individuals
    - ▪ Know your audience
    - ▪ Celebrate success stories
- o Influencers (who have credibility in FS)- messages should be developed by those who have been through it or implemented
    - ▪ FD model is notorious for change- need communication for smooth transitions. Document needs to be easy to understand and easily transferable
    - ▪ Regional resources- need to be the right people who are going to stay around- must be a screening system, hands-on from the Work Group
    - ▪ Could it be a funded position? Could help to maintain qualified individuals
    - ▪ Include FFs in the creation of materials- at least for review, community-based participatory approach
- o Many high-quality programs competing at the same time slot that there is no way to acquire all the information
- Make videos ~2minute – one thing about sleep- one thing about nutrition
    - o 6 minutes for safety is what WL FF's use- could mimic this model
        - ▪ "Just in time training."
    - o Utilize FS orgs to push out content – social media pages that every FF visits
    - o YouTube is a great source for posting videos
- Evaluation of the effectiveness of Wellness Toolkit- assessment of knowledge pre-distribution and post-implementation
    - o Look at the breakdown of efficacy-
    - o Needs assessment- what works best for small FDs? What works best for larger FDs? What works for remote and municipal FDs?
- Reach out to the Center for Public Safety Excellence and encouraging them to incorporate a component of Firefighter wellness for their Officer credentialing programs.
    - o Most of what we were talking through will require support from Chief level officers; many of these officers are or will become credentialed (FO, CTO, CFO). If one of the requirements to become credentialed was to describe your wellness contributions to your organization or how you plan to continue to incorporate wellness, it would be one more opportunity to expand this group's mission.

What discipline(s) of Research should be engaged?
- Incorporated above - need to utilize established and reputable fire service organizations, fire service researchers from <u>all</u> disciplines
- Need a Work Group of fire service orgs
- Need a resource group that is available to regional leaders

APPENDIX F:
FIRE SERVICE ORGANIZATIONS

Domain 1 participants requested a list of national fire service organizations and other related organizations to be included as a resource for researchers. This list is not an exhaustive list.

American Fire Sprinkler Association

Center for Campus Fire Safety

Center for Public Safety Excellence

Christian Regenhard Center for Emergency Response Studies (RaCERS) at John Jay College of Criminal Justice (CUNY)

Common Voices

Congressional Fire Services Institute

Cumberland Valley Volunteer Firemen's Association

Federation of Fire Chaplains

Fire and Emergency Manufacturers & Services Association

Fire Apparatus Manufacturers' Association

Fire Department Safety Officers Association

Fire Engineering Magazine

Fire Protection Research Foundation

Firefighter Cancer Support Network

Firehouse Magazine

FireRescue Magazine

FireRescue1/Fire Chief

Institution of Fire Engineers – United States of America Branch

Insurance Services Office

International Association of Arson Investigators

International Association of Black Professional Fire Fighters

International Association of Fire Chiefs

International Association of Fire Fighters

International Association of Wildland Fire

International City/County Management Association

International Code Council

International Fire Buff Associates

International Fire Marshals Association

International Fire Service Training Association

International Municipal Signal Association

International Public Safety Data Institute

International Society of Fire Service Instructors

Johnson Controls

National Association of Emergency Medical Technicians

National Association of EMS Physicians

National Association of Hispanic Professional Firefighters

National Association of State Fire Marshals

National Board on Fire Service Professional Qualifications

National Fallen Firefighters Foundation

National Fire Protection Association

National Fire Sprinkler Association

National Interagency Fire Center

National Volunteer Fire Council

North American Fire Training Directors

Society of Fire Protection Engineers

Underwrite Laboratories

USA Sprinkler Fitters

VFIS

Wildland Firefighter Foundation

Women in Fire