Wildland Fire
Injury and Fatality Incident Analysis:

Themes within Condition of Influence

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The purpose of this report

Human Performance & Innovation and Organizational Learning Research, Development & Applications (HPIOL) has undertaken a meta-analysis of recent wildland fire fatality and injury incidents. The purpose of this report is to explore commonalities which may exist *across* "types of incidents" and *within* "conditions of influence" in fatality and serious injury reports identified by HPIOL.

How the data was collected

The HPIOL team selected the sample by identifying the three most prevalent Mechanisms or Accident Types that occurred in wildland fire from 2007-2016. From the top three types (Acute Medical, Hit By, and Motor Vehicle Accidents for injuries, and Aviation, Hit by, and Entrapments for fatalties), 18 unique injury incidents and 18 unique fatality incidents were selected for review. The sampling process is as follows:

1) HPIOL acquired Facilitated Learning Analyses or other learning products for each incident through the Wildland Fire Lessons Learned Center database.
2) From these summary documents, HPIOL then read and excerpted or summarized key content to produce multiple data references, or Condition Details, for each incident.
3) HPIOL categorized the Condition Details by 18 Conditions of Influence. The Conditions of Influence are listed and ranked in Table 1 by highest number of fatality references, with comparative injury ranking.
4) RMRS HD Social Scientists conducted an additional analysis of commonalities which may exist *across* "types of incidents" and *within* "conditions of influence." This report serves as the RMRS HD Social Science analysis.

Table 1. Conditions of Influence: Prevalence in Sample, Ranked by Injury References[1]

Fatality References			Condition of Influence	Injury References		
n	Difference	Rank	Name	Rank	Difference	n
117	0	1	Operational Influences	1	0	67
110	-2	2	Signal Detection	4	2	60
103	-2	3	Environmental	5	2	60
75	-2	4	Individual Influences	6	2	55
71	-2	5	Organizational Influences	7	2	55
65	4	6	Training/Experience	2	-4	53
59	-5	7	Historical	12	5	40
55	5	8	Culture	3	-5	38
49	-4	9	External Influences	13	4	28
47	1	10	Guidance, Policy, and Regulations	9	-1	27
43	3	11	Communications	8	-3	15
30	-2	12	Equipment	14	2	12
26	2	13	Leadership	11	-2	12
25	4	14	Social Relationships	10	-4	4
11	0	15	Memory Items	15	0	4
3	0	16	Aviation	16	0	3
1	0	17	Assumptive Behavior	17	0	1
1	0	18	Plan Continuation	18	0	1

[1] As organized by HPIOL, the sample data show consistent rankings between the fatality and injury references in the most (1 Operational Influence) and the least (Rankings 15-18) frequent references, highlighted in orange. Close rankings between fatality and injury references also exist between 2-5 and 10, highlighted in gold and white. That is, based solely on this table, it is plausible that similarly ranked conditions (Signal Detection, Environmental, Individual, and Organizational Influences) differ not in quality but in increased frequency of the condition when fatalities occur. More distance between rankings of fatality and injury Conditions of Influence is indicated in blue and green.

How the data was analyzed

Data (Condition Detail x Condition of Influence) provided from HPIOL to RMRS HD Social Scientists for fatality incidents totaled 891 references, and data for injury incidents totaled 535 references. Given the large volume of qualitative data, we used computer-assisted qualitative data analysis software (CAQDAS) to analyze a total of 1,426 references. It is important to note that the analytical task of exploring data for patterns within each of the 18 Conditions of Influence is an emergent process, with the data driving the researchers' interpretive coding, but within the boundaries established by HPIOL Conditions. While RMRS HD Social Scientists referred to FLAs for incident context, were provided with definitions for each Condition of Influence, and accessed the online USFS Fire Terminology dictionary when necessary, our interpretations of certain fire terms may be incongruent with those of HPIOLand/or the greater wildland fire community.

Given the contextual limitations and the time constraints of this project, we combined the multiple Excel worksheets provided by HPIOL into two long-form worksheets—one for fatality data and one for injury data. We then divided our labor by analyzing the fatality and injury data separately. As a result, we each came up with two separate ways of reporting our findings in this report. For future reference, please let us know which type of reporting style you prefer - reporting style for fatalities, reporting style for injuries, or a different reporting style. Given these two separate reporting styles, we nonetheless followed the same protocol of sorting all references by Condition of Influence, evaluating each reference as nuanced by its Condition of Influence, and creating additional interpretive codes for each reference.

The process of analyzing qualitative data is complex. To illustrate how data from 36 incidents grows in magnitude, consider a single incident.
1) HPIOL extracted 33 Condition Details from the Frog Fire Entrapment Fatality, including brief notations ("Squirrely winds") and narrative details ("Dave did not show up for transfer of command to IC3, the other two crew were waiting for an extended period of time").
2) Each Condition Detail, however, could be and often was multiply categorized. For example, "Aggressive initial attack is highly valued and is generally the standard operating procedure" was categorized by HPIOL across five Conditions of Influence—Culture, External, Historical, Operational, and Organizational.
3) The Frog Fire incident, having 33 Condition Details multiplied by the Conditions of Influence assigned, produced 71 unique data references.
4) These 71 unique data references were then analyzed by RMRS HD Social Scientists using CAQDAS.
5) A final synthesis was then conducted along with all other fatality incidents using CAQDAS.

Results from analysis on fatalities
(891 References)

The "Conditions of Influence" in bold were provided by HPIOL and were used as the primary themes in this analysis. The subthemes are patterns that emerged within "Conditions of Influence," and are presented in bullet and underline form along with their definition.

Assumptive Behavior
(1 Reference)

No site assessment.

Aviation
(3 References)

Incidents occurred suddenly and unexpectedly.

Communications
(43 References)

- Assumptions: Assumptions were made without verification of whether or not the information was received or understood. Employees making assumptions about where to be and what should or shouldn't be done.
- Clear Communication: Communication is clear and understood. Either refused, or accepted risk due to common ways of getting work done, and common beliefs about how much risk should be taken to protect resources and structures.
- Confusion: Communication of different needs was overwhelming and as a result there was confusion and misunderstanding.
- Routinization: Personnel entered into a routine despite safety hazards, their lack of experience with other personnel, and/or unfamiliar terrain. As a result, unique conditions were not communicated.

Culture
(53 References)

- Acceptance of risk: FS Employees know there is danger in the task but accept the risk to get the job done. Don't inform supervisors of risk. Levels of risk between Forest Service and other agencies differ during the decision making process.
- Eagerness to get the job done: Employees are eager to get the job done. Full suppression and keeping the fire small is a measure of success. Want to show a "can do" attitude and do not want to admit failure.
- Risk Assumptions: Assumptions about risk are made without verification. When working with other agencies, assumptions are made about the role of FS firefighters. FS firefighters also assume that they must suppress fire to save homes and structures.
- Routine: Everything was routine. There was nothing done out of the ordinary. Protecting houses and structures is common practice.

Environmental
(102 References)

- Hazardous condition: Hazardous environment such as intense fire, smoke, hazard trees, and heavy fuels. Access is threatened due to hazardous conditions. Hazardous conditions and lessons learned are considered or ignored to complete the work.

- Natural environment: The natural environment such as snags, steep canyons, and difficult terrain had an impact on the incident. Natural resource values at risk.
- Physical man-made structures: Parts of the environment that are not natural and are physical structures which influenced decision making. Physical structures increased risk level.
- Weather: The weather such as strong wind, wind direction, and dry conditions had an impact on the situation. A lightning strike was reported resulting in burning trees and intense fire activity.

Equipment
(30 References)
- Common risks: There is a common understanding that certain equipment is more dangerous but more efficient and easy to use. Therefore, the higher risk is accepted in order to complete the task.
- Do not use proper equipment: The proper equipment would have made a difference but was either not available or a decision was made not to use it.
- Failure of equipment: There was a failure of engine, vehicle, machine, or other mechanical equipment during the incident.

External Influences
(49 References)
- Expectations from agencies: External agencies have different goals, norms, culture, and expectations for accomplishing the task. There is miscommunication and confusion between agencies. Goals also differ within different Forest Service units.
- Expectations from the public: Expectations from the public differ from the expectations of managers. Unspoken rule to protect homes and structures.
- External conditions: Responses to unexpected changes in conditions and risk.

Guidance, Policy, and Regulations
(46 References)
- Different policies, guidelines, and levels of risk: There were differing policies, guidelines, procedures, and levels of risk between agencies and groups that were required to work together.
- Lack of oversight: There was lack of oversight in the steps that were taken, which led to improper procedures, assumptions, and mistakes.
- Values at risk: Policies and guidelines that are impacted by values such as natural resources, homes, infrastructure.

Historical
(59 References)
- Mismatch between policy and application: Guidance and policies do not match situation on the ground. At times guidance and policy were followed when conditions made them ineffective. At other times decisions on the ground did not follow guidance, policy and procedures.
- Normal conditions: Nothing was out of the ordinary. Conditions were the same as before.
- Unexpected conditions: Conditions were out of the ordinary from conditions in the past. There were significant abnormal actions taking place during the incident.

Individual Influences
(75 References)
- Assumptions made without verification: Assumptions that lead to decisions made by individuals and groups on how to proceed. Policies not matching decisions made.

- Beyond individual control: Conditions, situations, or resources that are beyond the control of an individual.
- Change in decision: A sudden change in decision was made due to shift in conditions or personnel changes and arrivals.
- Desire to take action: The desire to take some sort of action to accomplish the task despite the overall risks. A strong sense of responsibility to be the individual or group responsible for accomplishing the task.

Leadership
(26 References)
- Confusion: Confusion over who is in charge, changes in leadership, and failure to provide clear guidance.
- Leadership decision: The leader made a decision that had an impact on the outcome. Communication on leader expectations were clear and there was trust in the decision.

Memory Items
(11 References)
> Memorable decisions that are made in reaction to a change in conditions, or as a reaction to options available at the time.

Operational Influences
(118 References)
- Beyond operational control: Situations when it is believed that incidents occur outside of operational control such as the natural environment and mechanical situations.
- Followed protocol: Those involved believe that the appropriate protocol was followed when the incident occurred.
- Not following protocol: Situations where the protocol was either not followed or an alternative method should have been used. Risk is being taken in situations that are beyond normal operating procedures because there is a cultural norm of assuming certain risks.

Organizational Influences
(67 References)
- Cost and efficiency: Risk is taken to cut cost and to be more efficient. Risk is seen as necessary to increase and/or maintain production.
- Cultural acceptance of risk: There is a cultural acceptance of risk that helps to maintain decision making and the organizational structure.
- Failure of organization: Failed checks and balances within the organization. Different organizations with conflicting decision making processes and perspectives.

Plan Continuation
(1 Reference)
> Resistance to changing plans.

Signal Detection
(110 References)
- Miscommunication: There was miscommunication about the situation and what was needed.
- Normal situation: No out of the ordinary conditions or events.

- Unexpected situation: An event occurred suddenly and unexpectedly. These unexpected events typically have to do with weather, personnel changes, or mechanical failure.

Social Relationships
(26 References)
- Common understandings: Cultural norms that guide common understandings that are outside of policies in the way tasks get accomplished.
- Personal communication: How personnel understand and/or do not understand each other. How people feel toward decisions and one another. Lack of trust and understanding creates confusion.

Training/Experience
(65 References)
- Do not follow training or procedures: During the incident the training or procedures were not followed and created confusion.
- Followed training: During the incident training procedures were followed, but problems continued to occur.
- Level of experience: Personnel were adequately trained but lacked experience with the particular situation.

Results from analysis on injuries
(535 References)

Subtheme definitions for all injury references are provided here, followed by a frequency table showing the density of subtheme codes for each Condition of Influence.

Table 2. Injury Themes Codebook

Subtheme	Definition
Atypical	The conditions experienced by actors were atypical, intermittent, or coincidental.
Change	Change in conditions or plan occurred and challenged the actor response: change in season, weather, lake conditions, tanker fill site conditions, fire conditions, forest health; workflow, crew and leader resolve, operational expertise, crew composition; or actor's health.
Cohesion	Actors demonstrated group or interpersonal cohesion, which was mostly--but not always--effective in producing a better outcome.
Complexity	Activities, situations, and/or responsibilities multiplied, increasing the complexity involved in maintaining control on original objectives and adjusting to new conditions. Competing priorities increased risk.
Decision	Decision for action was: a firm consensus among actors; pressured by the agency; understood as the modus operandi; made without hesitation or re-verification; made with resolve; was unquestioned, unyielding, or stubbornly adhered to.
Information: Known	Information was known to actors.
Information: Unknowable	Information was uncertain, unable to be known when action was being taken.
Information: Unknown	There was an absence of knowledge, unconfirmed information, lack of information gathering, or incorrect knowledge, as related to the condition of influence.
Jurisdiction-Rank-Expertise	Leadership crossed into another/unfamiliar jurisdiction; resources worked beyond their jurisdiction or role; transition between jurisdictional lead; hierarchical practices impaired judgment or information transfer; multi-agency operations added difficulty.

Performance: Compromised	Actors were incapable of being fully engaged due to fatigue, overwork, injury; distraction, disinterest, complacency, normalization of risk; solitary work, insufficient staffing, multitasking; embarrassment, lack of oversight; profit motive; or otherwise did not adequately perform their role.
Performance: Effective	Actors performed their roles effectively, given the condition.
Planning: Unplanned	Plans were not made, or were uncertain; or there was disregard for the established plan of action.
Planning: Pre-planned	Activities were planned and scheduled; contingencies were planned prior to activities being executed; planned pauses and instruction during activity were conducted.
Preparation: Inadequate	Actors did not adequately prepare for changing conditions, new situations, shared jurisdictions, new terminology, or new guidelines. Teams did not have adequate staffing; actors did not have adequate leadership; did not have adequate training or experience; did not prepare teams with coherent plans/maps/information.
Proximity	Adequate distance was not established (or was unable to be established) between at least two activities or hazards; or direct approach or driving conditions decreased capacity for safe distance.
Radio: Limitations	Incidents with radio frequency redundancies; radio was the sole communication; radio traffic was congested; or radio protocol was not followed.
Scope: Wrong	Actors focused on future scenario of unfortunate outcomes, rather than focusing on present situation and solutions; used wrong basis of comparison or wrong historic baseline; applied decisions with restricted perspective or memory; actions were inordinate to necessity, parsimony, or safety.
Solutions: Limited	Methods for resolving, mitigating, or eliminating the event were limited by the immediate situation, the environment, or by organizational pressures or negligence.
Terminology	Terminology was miscommunicated or misunderstood.
Timing	Report stated metrics of exact timing; or timing was expressed in different degrees of urgency or complacency; favourability of timing; timing when contingencies should be enacted; limited window of opportunity to complete operation; appropriate timing of workflow; sequence of events could have been interrupted; or season was running long.

Table 3 breaks across three pages, with each section displaying the results of six Conditions of Influence. The Conditions of Influence are organized from most to least prevalent, left to right. Bold typeface and cell borders more prevalent if not stronger results. This is a visual cue only and is not intended as any measure of statistical significance. The qualitative data here represent counts only; they were not reprocessed for statistical tests of association or inference. Please note that conceptually, several subthemes could be further collapsed. The greater variation in subthemes expressed in the injury data is a result of analyst judgment regarding presentation style.

Table 3-A. Injury References by Condition of Influence, with Subtheme Frequencies

1 of 3 / Subtheme	Operational Influences	Training-Experience	Culture	Signal Detection	Environmental	Individual Influences
References	*67*	*60*	*60*	*55*	*55*	*53*
6 Atypical	1	1	1	0	1	0
34 Change	**10**	0	2	1	**9**	3
22 Cohesion	1	2	3	1	0	3
42 Complexity	5	**8**	**7**	0	**9**	1
41 Decision	2	4	**9**	4	0	**11**
72 Information: Known	3	4	**8**	19	14	5
7 Information: Unknowable	1	0	0	3	1	1
30 Information: Unknown	2	2	3	**8**	2	3
31 Jurisdiction/Rank/Expertise	3	3	4	1	1	**6**
31 Performance: Compromised	2	4	4	3	2	**6**
30 Performance: Effective	1	**9**	0	5	2	3
10 Planning: Unplanned	4	0	2	0	0	0
31 Planning: Pre-Planned	**10**	4	2	0	1	2
36 Preparation: Inadequate	5	**10**	3	1	2	3
16 Proximity	3	0	1	2	**6**	1
10 Radio: Limitations	2	0	0	0	0	0
44 Scope: Wrong	3	**9**	5	**6**	1	2
16 Solutions: Limited	4	0	2	0	1	0
2 Terminology	0	0	1	0	0	0
24 Timing	5	0	3	1	3	3

Table 3-B. Injury References by Condition of Influence, with Subtheme Frequencies

References	Subtheme	Organizational Influences	Communications	Guidance, Policy, and Regulations	Social Relationships	Leadership	External Influences
		40	38	28	27	15	12
6	Atypical	1	0	1	0	0	0
34	Change	0	1	0	4	1	0
22	Cohesion	1	1	1	7	2	0
42	Complexity	6	1	2	0	2	0
41	Decision	6	2	0	0	1	0
72	Information: Known	6	4	1	0	1	2
7	Information: Unknowable	0	1	0	0	0	0
30	Information: Unknown	0	5	2	0	0	1
31	Jurisdiction/Rank/Expertise	1	1	1	6	2	2
31	Performance: Compromised	0	0	3	4	2	1
30	Performance: Effective	0	2	2	3	1	1
10	Planning: Unplanned	1	2	1	0	0	0
31	Planning: Pre-Planned	4	3	1	0	0	0
36	Preparation: Inadequate	5	1	2	1	1	1
16	Proximity	1	2	0	0	0	0
10	Radio: Limitations	0	6	0	1	0	0
44	Scope: Wrong	1	4	6	0	2	3
16	Solutions: Limited	2	0	4	1	0	1
2	Terminology	0	1	0	0	0	0
24	Timing	5	1	1	0	0	0

Table 3-C. Injury References by Condition of Influence, with Subtheme Frequencies

3 of 3	Subtheme	Historical	Equipment	Memory Items	Aviation	Plan Continuation	Assumptive Behavior
References		*12*	*4*	*4*	*3*	*1*	*1*
6	Atypical	0	0	0	0	0	0
34	Change	2	0	0	1	0	0
22	Cohesion	0	0	0	0	0	0
42	Complexity	1	0	0	0	0	0
41	Decision	1	0	0	0	1	0
72	Information: Known	3	2	0	0	0	0
7	Information: Unknowable	0	0	0	0	0	0
30	Information: Unknown	0	0	2	0	0	0
31	Jurisdiction/Rank/Expertise	0	0	0	0	0	0
31	Performance: Compromised	0	0	0	0	0	0
30	Performance: Effective	0	1	0	0	0	0
10	Planning: Unplanned	0	0	0	0	0	0
31	Planning: Pre-Planned	2	1	1	0	0	0
36	Preparation: Inadequate	0	0	0	0	0	1
16	Proximity	0	0	0	0	0	0
10	Radio: Limitations	0	0	0	1	0	0
44	Scope: Wrong	1	0	1	0	0	0
16	Solutions: Limited	1	0	0	0	0	0
2	Terminology	0	0	0	0	0	0
24	Timing	1	0	0	1	0	0

The most common subthemes, across all Conditions of Influence, for all injury references are displayed below in order of prevalence.

1) The most common subtheme is based on whether individuals seemed to know the condition details before or while they were taking action.
2) Other middle-ranking subthemes which contributed to various Conditions of Influence included the social boundaries of jurisdiction, rank, or expertise; operational issues of planning; and the status of information as unknown (but knowable).
3) Surprisingly, themes regarding compromised versus effective performance outcomes were similar.
4) Timing of action, cohesion of team, and proximity of action all speak to the relative temporal and spatial aspects that were evident in many references.
5) The remaining lower ranking subthemes of limited solutions, unplanned action, radio limitations, unknowable information, atypical conditions, and terminology issues relate to the constraints faced under many of the Conditions of Influence.

Table 4. Injury Themes, by Prevalence

References n=535	Subtheme
72	Information: Known
44	Scope: Wrong
42	Complexity
41	Decision
36	Preparation: Inadequate
34	Change
31	Jurisdiction/Rank/Expertise
31	Performance: Compromised
31	Planning: Pre-Planned
30	Information: Unknown
30	Performance: Effective
24	Timing
22	Cohesion
16	Proximity
16	Solutions: Limited
10	Planning: Unplanned
10	Radio: Limitations
7	Information: Unknowable
6	Atypical
2	Terminology

Finally, in this report, while we have done our best to find emerging themes from the data, please note that this analysis was conducted out of context from the broader investigations on fatality and injury incidents. We leave it to HPIOL to fill-in the blanks where necessary, identify inaccuracies, and use this report as needed for the benefit of organizational learning.