Wildland Firefighter Smoke Exposure

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Job of Wildland Firefighter

Table 1 Wildland firefighter job tasks categorised into four groups based on activity level and percentage of total person-task observations in the data set in the Wildland Firefighter Heat Related Illness study, Western United States, 2013–2016

Sedentary activity	%	Light physical activity	%	Moderate physical activity	%	High physical activity	%
ICP Stationary	1.7	Handline Direct Pump	0.1	Mop Up	5.1	Handline Direct Scratch	0.7
ICP Other	0.2	Handline Indirect Pump	0.02	Cold Trailing	0.6	Handline Direct Sawyer	0.5
Briefing	6.7	Handline Indirect Dozer Boss	0.02	Improving Direct Line	0.2	Handline Direct Swamper	0.6
Driving	6.9	Holding Direct Line	1.3	Improving Indirect Line	1.1	Handline Direct Engine	0.1
Lunch Break	3.6	Holding Indirect Line	0.2	Felling Sawyer	0.6	Handline Direct Squad Leader	0.1
Rest Break	3.3	Holding Firefighter	0.7	Felling Swamper	0.6	Handline Direct Firefighter	0.2
Operational Break	19.5	Holding Squad Leader	0.2	Working with Aviation	0.1	Handline Indirect Scratch	0.4
Staging	0.9	Holding Engine	0.1	Scouting Hazard Trees	0.7	Handline Indirect Sawyer	0.6
Other	0.5	Suppression Holder	0.8	Grid the Black	1.5	Handline Indirect Swamper	1.2
Total	**43.2**	Engine Pump Operator	0.2	Grid the Green	0.6	Handline Indirect Squad Leader	0.3
		Holding Pump	0.1	Tool Up/Tool Down	8	Handline Indirect Firefighter	0.2
		RX Holder	0.2	**Total**	**19**	Line Preparation	0.5
		Refurb Tools	3.3			Initial Attack	0.1
		Structure Protection	1.1			RX Lighter	0.2
		Compound Work	1.4			Suppression Lighter	0.8
		Total	**9.4**			Physical Training	1.3
						Project Saw	0.6
						Project Stacking	0.7
						Hiking	19.2
						Medical	0.1
						Total	**28.4**

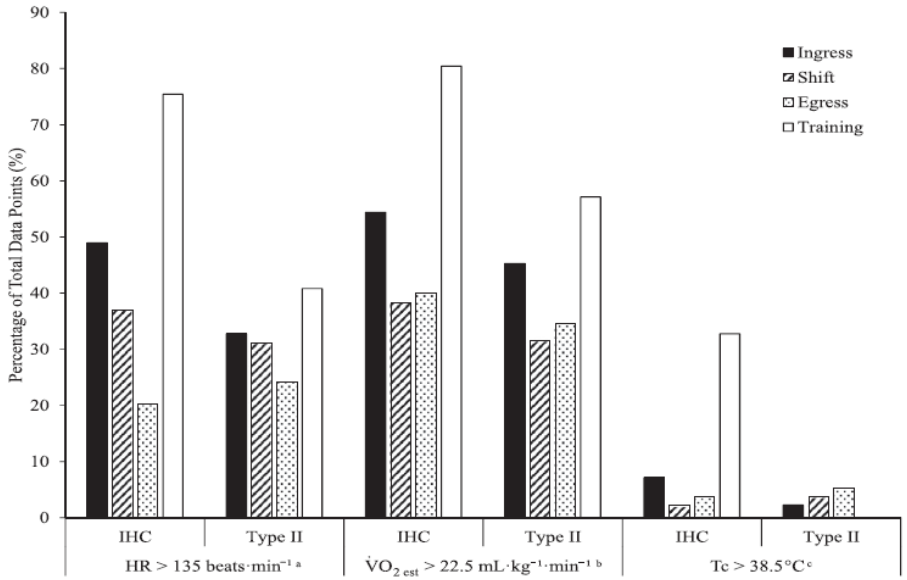
See glossary of terms in online supplementary appendix for definitions of job tasks.

ORIGINAL RESEARCH

Risk for heat-related illness among wildland firefighters: job tasks and core body temperature change

Molly R West [1,2] Sadie Costello,[3] Joseph A Sol,[2] Joseph W Domitrovich[2]

Job of Wildland Firefighter



[a] - 135 beats·min^{-1} represents HR value associated with the ventilatory threshold of WLFFs[44].

[b] - 22.5 mL·kg^{-1}·min^{-1} represents the metabolic demand of the current WLFF Work Capacity Test[7-9].

[c] - 38.5 °C represents the core temperature representative of the onset of risk for heat exhaustion[41].

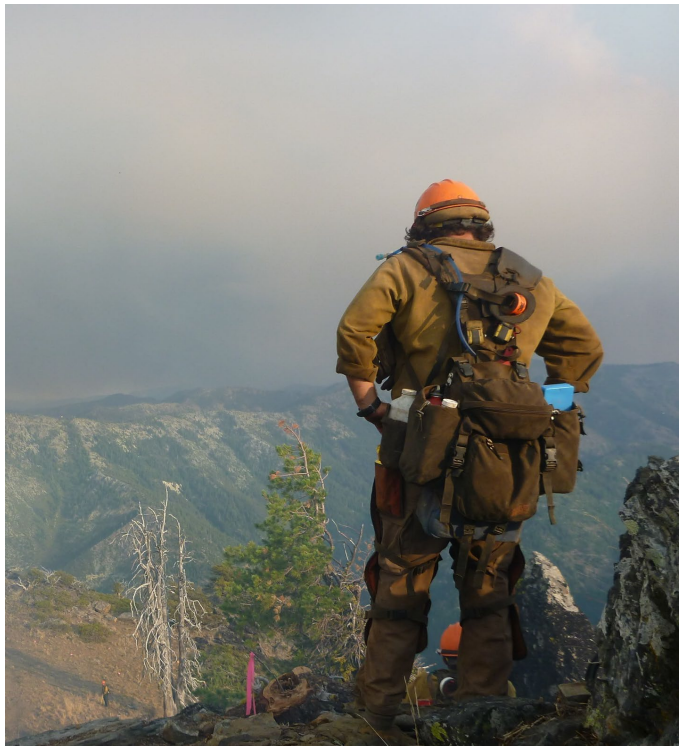
WILDERNESS & ENVIRONMENTAL MEDICINE (2018) ▮, ▮▮▮–▮▮▮

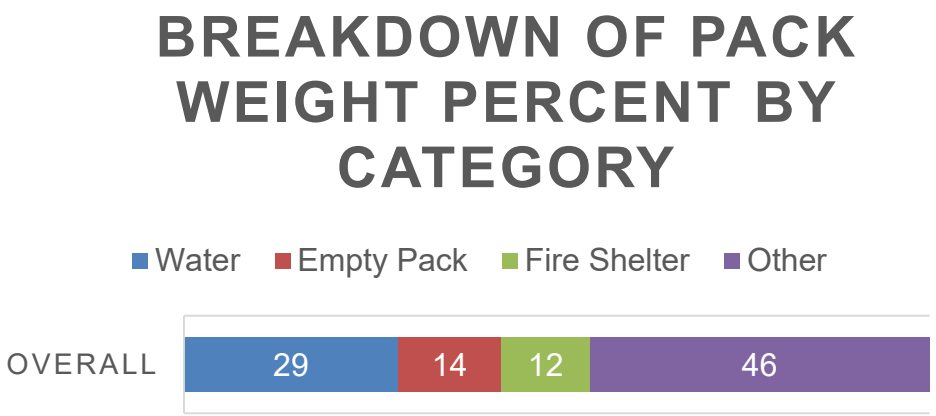
ORIGINAL RESEARCH

Metabolic Demand of Hiking in Wildland Firefighting

Joseph A. Sol, MS; Brent C. Ruby, PhD; Steven E. Gaskill, PhD; Charles L. Dumke, PhD; Joseph W. Domitrovich, PhD

Weight




BREAKDOWN OF PACK WEIGHT PERCENT BY CATEGORY
Water
Empty Pack
Fire Shelter
Other
OVERALL
29
14
12
46

Exposure Profile

Table 2. Summary metrics for occupational exposures among U.S. wildland firefighters and fire managers (2009–2012).

Distribution Metrics	CO 1-Min Avg. (ppm)	CO 5-Min Avg. (ppm)	CO 8-hr Avg. (ppm)	CO Fireline Avg. (ppm)	CO Shift Avg. (ppm)	PM4 Shift Avg. (mg/m^3)	Quartz Shift Avg. (mg/m^3)	Quartz Shift PEL (%)
OEL Criterion	1200	200	35	25	16	0.7[C]	0.029[F]	100
Initial Attack (n)	60[A]	60[A]	50	50	50	18	18	18
UTL (95%/95% UCL)	317	224	41	60	26	1.1	0.321	1370[D]
95th percentile	212[B]	141[B]	20[B]	30[B]	13[B]	0.54[B]	0.116[B]	430[B]
95% UCL of mean	61[B]	34[B]	3.1[B]	4.3[B]	2.1[B]	0.28[B]	0.043[B]	144[B]
Arithmetic Mean	51[B]	28[B]	2.4[B]	3.5[B]	1.6[B]	0.21[B]	0.028[B]	90[B]
Geometric Mean	29	14	0.8	1.4	0.58	0.13	0.012	31
GSD (unitless)	3.4	4.0	7.0	6.4	6.6	2.4	4.0	4.9
Nondetects (%)	1.7	1.7	2.0	2.0	2.0	61	44	44
Exposures > OEL (%)	0.0[B]	0.0[B]	0.0[B]	0.0[B]	0.0[B]	5.6[B]	28[B]	28[B]
95% UCL of > OEL (%)	4.9[B]	4.9[B]	5.8[B]	5.8[B]	5.8[B]	24[B]	50[B]	50[B]
Project Fire Crews (n)	417	417	417	417	417	80	80	80
UTL (95%,95% UCL)	572	368	68	62	44	1.9	0.191	649
95th percentile	489[B]	308[B]	53[B]	48[B]	34[B]	1.4[B]	0.119[B]	403[B]
95% UCL of mean	119[B]	60[B]	6.1[B]	5.6[B]	3.8[B]	0.57[B]	0.034[B]	115[B]
Arithmetic Mean	108[B]	54[B]	5.5[B]	4.9[B]	3.5[B]	0.49[B]	0.027[B]	90[B]
Geometric Mean	61	29	2.0	1.7	1.3	0.35	0.010	33
GSD (unitless)	3.6	4.2	7.3	7.7	7.3	2.4	4.6	4.6
Nondetects (%)	1.7	1.7	1.7	1.9[E]	1.7	10	38	38
Exposures > OEL (%)	0.5[B]	1.7[B]	0.5[B]	1.0[B]	1.0[B]	22[B]	28[B]	28[B]
95% UCL of > OEL (%)	1.5[B]	3.1[B]	1.5[B]	2.2[B]	2.2[B]	30[B]	37[B]	37[B]

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Factors affecting smoke and crystalline silica exposure among wildland firefighters

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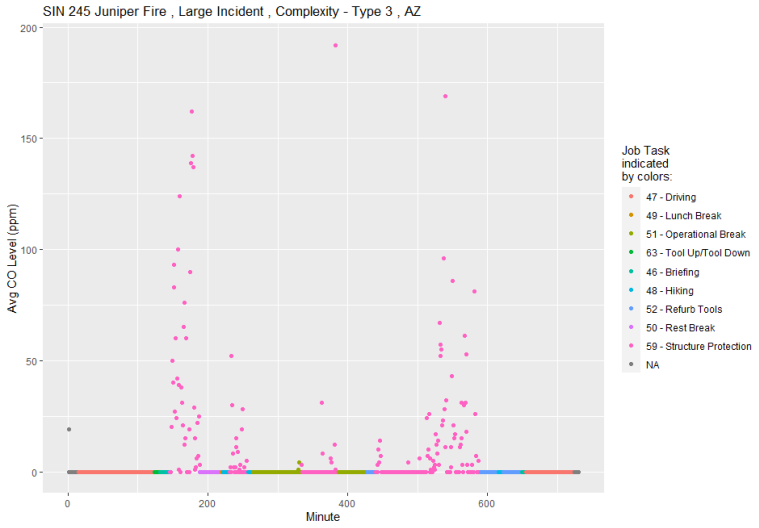
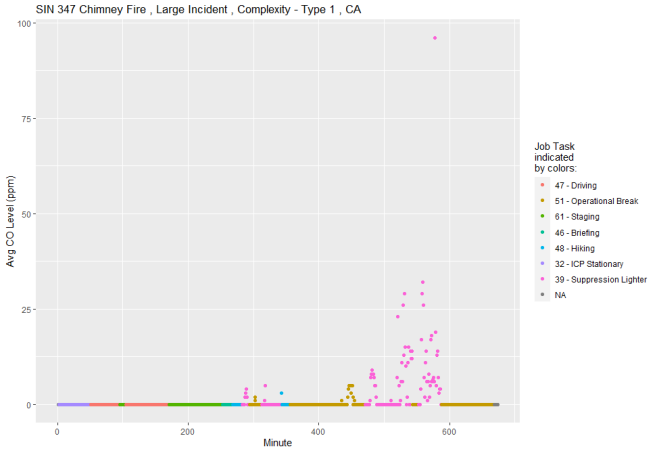
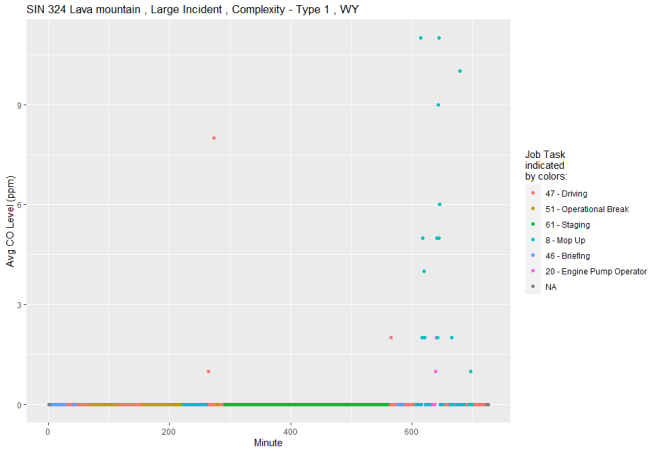
Exposure Profile







Health Risk

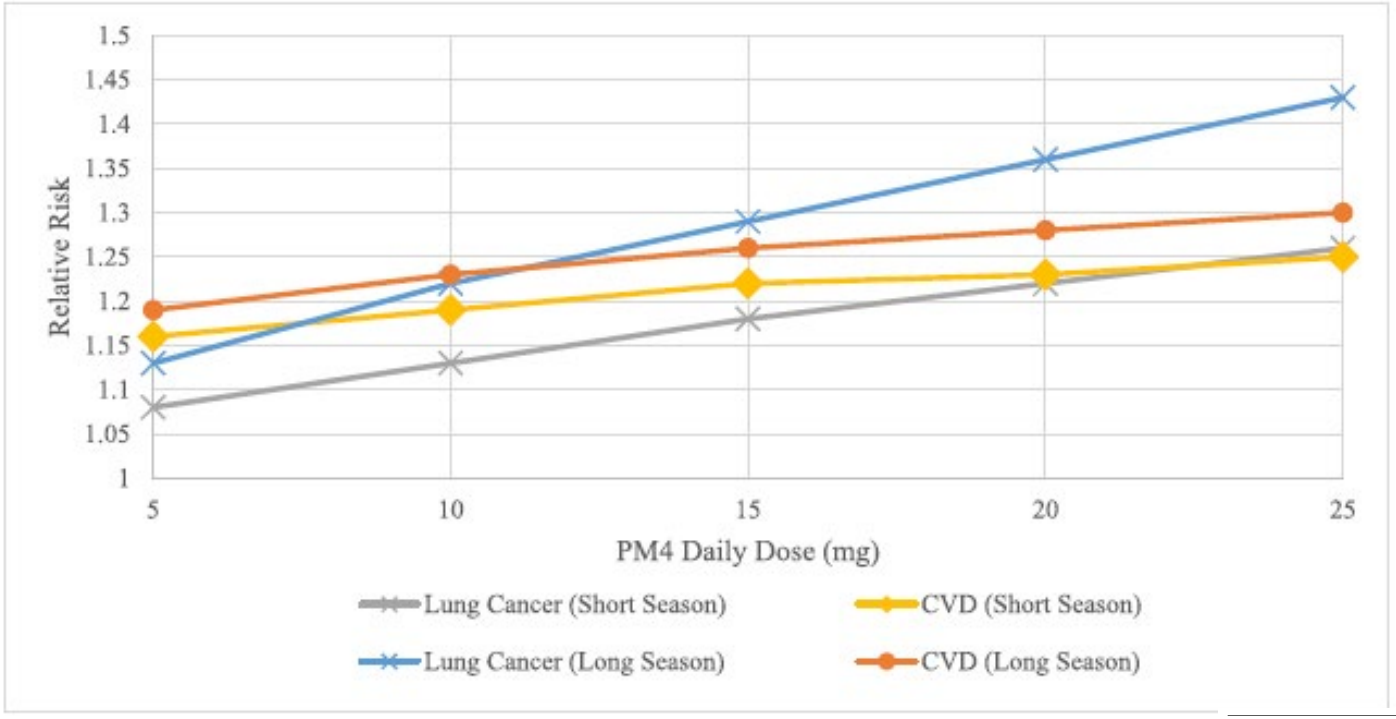


Fig. 1. Relative risk of lung cancer and cardiovascular disease across career length.

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Wildland firefighter smoke exposure and risk of lung cancer and cardiovascular disease mortality

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Respiratory Protection