

# Health Beliefs, Health Behavioral Intentions, and Lead Contamination Threats in Mining-Impacted Communities

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## Study Motivation

Lead is present at 50% of Superfund sites in the United States. Exposure-reducing health behaviors are important, even in areas that have experienced extensive remediation. Lead is an invisible contaminant and even low levels of exposure are tied to negative health outcomes including higher rates of non-communicable disease and developmental delay in children. Exposure pathways can include ingestion or inhalation of dust particles containing lead. Women and children are at greatest risk from exposure.



Figure 1. Miner in HECLA Galena mine, 1906

## Research Objectives

- Assess how aware of lead contamination threats and how often people living in a mining-impacted area may encounter possible lead contamination.
- Examine the strength of associations between health beliefs about lead contamination threats and intentions to practice recommended health behaviors using the Health Belief Model as the theoretical basis.

## Expected Associations

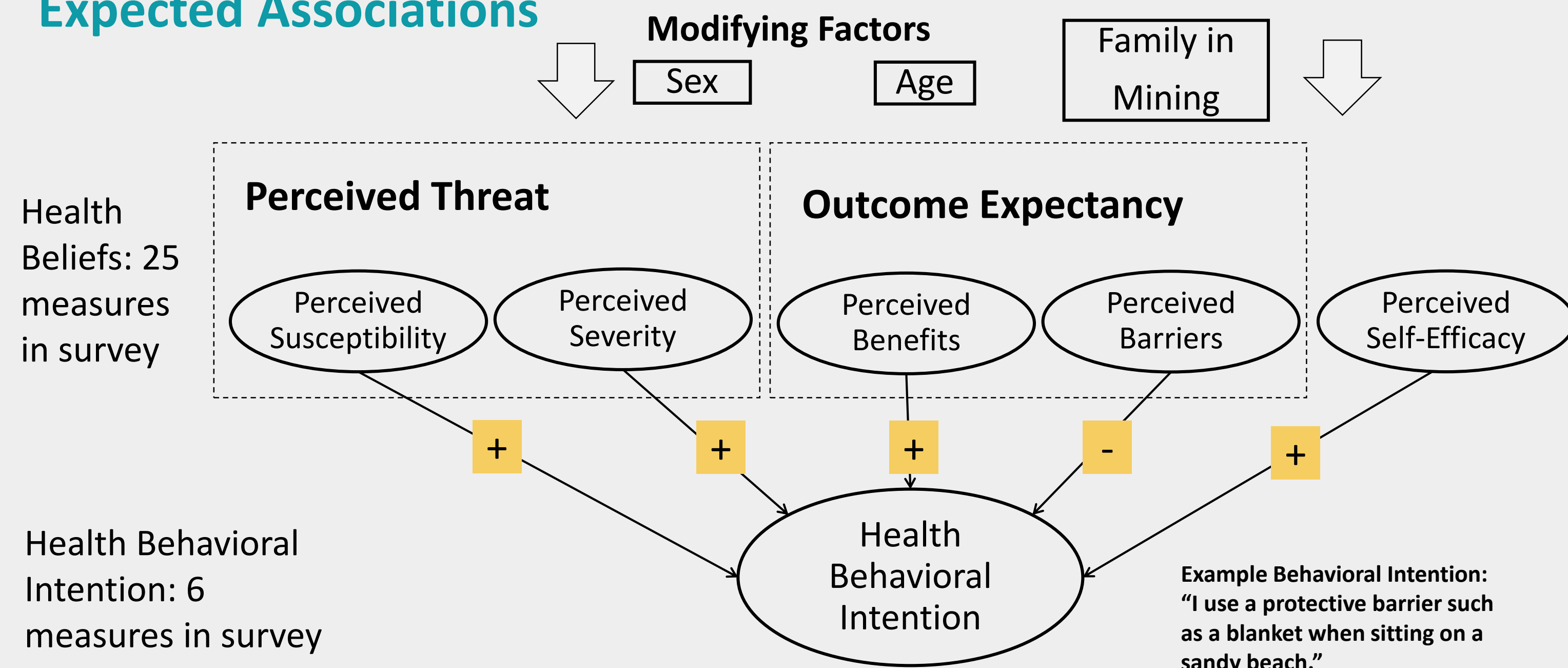


Figure 2. Proposed model of health belief constructs and health behavioral intention. We also expected that the health belief variables would correlate with one another.

## Study Context

Shoshone County, Idaho has a population of 12,765. It is also the site of a complex Superfund clean-up (designated in 1983). The extensive floodplains and wetlands provide wildlife habitat and popular recreation areas. However, contamination from mine waste is widespread. In addition, the county is characterized by extensive socio-economic and health disparities.

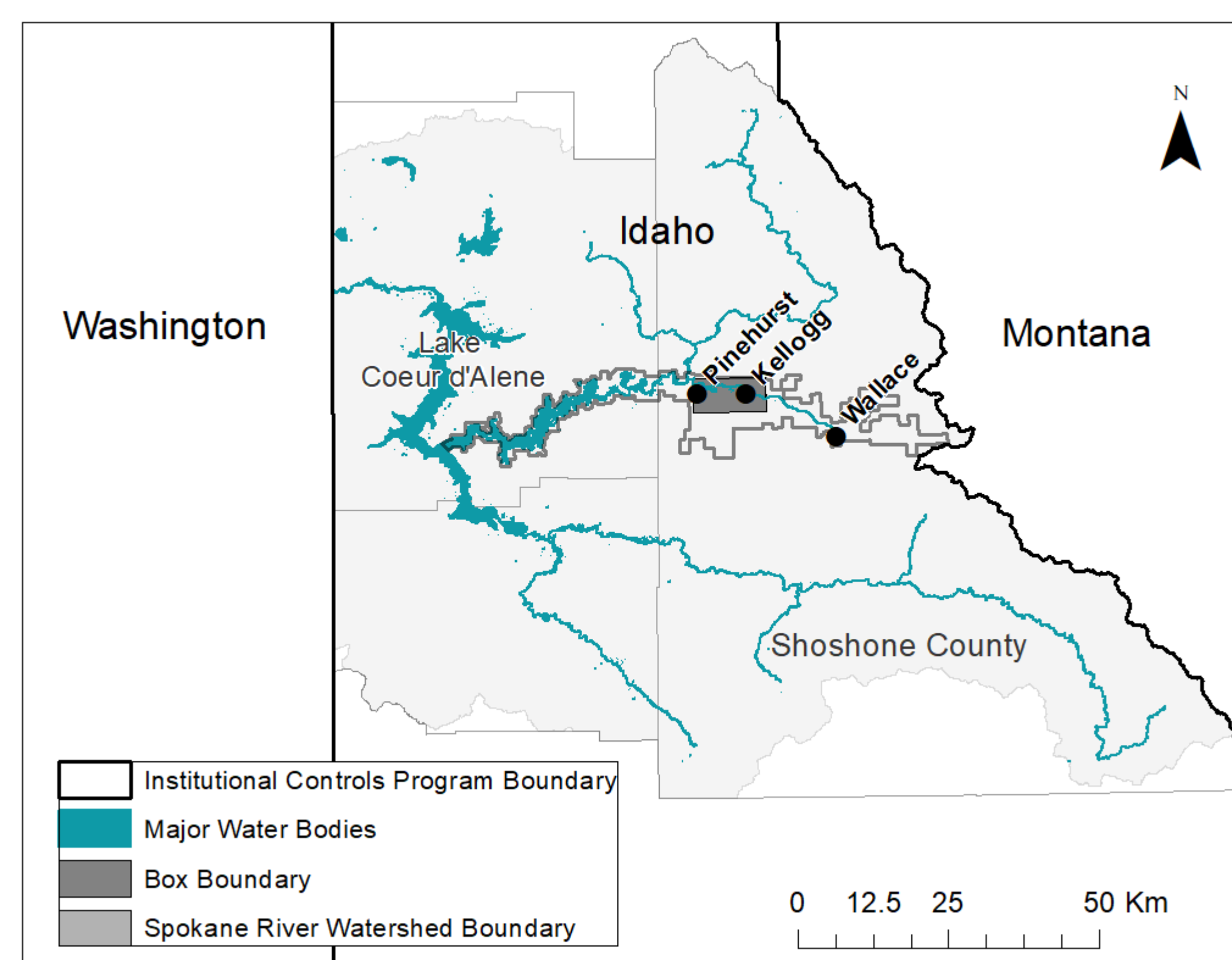


Figure 3. Map of the study region including the three study communities and primary Superfund site boundaries.

## Methods

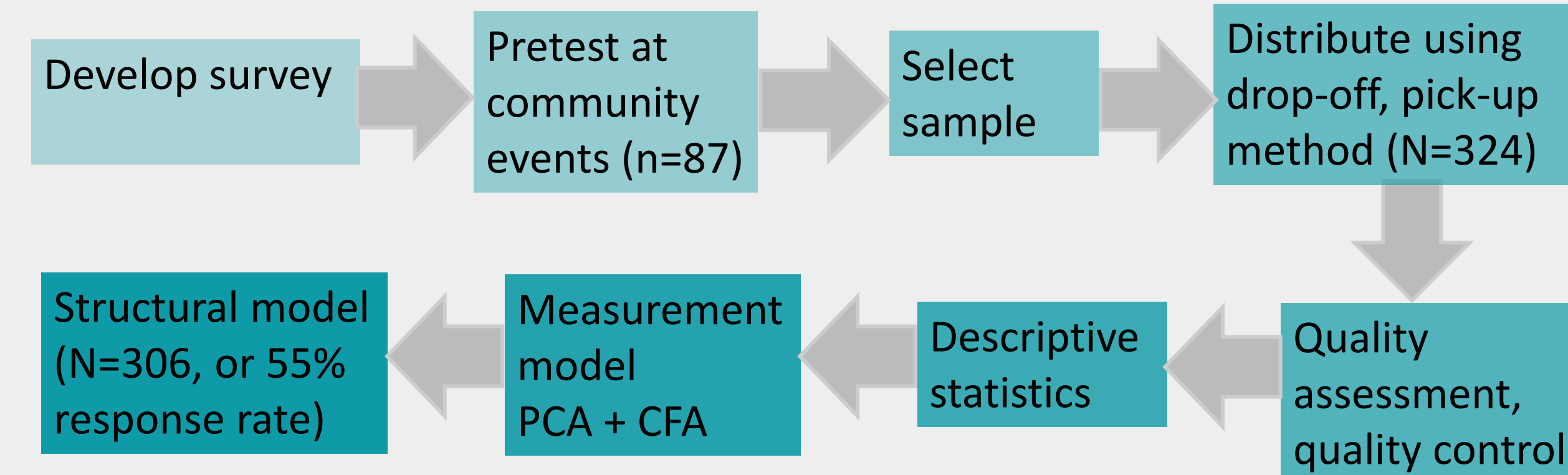


Figure 4. The study design was based on a drop-off, pick-up survey approach.

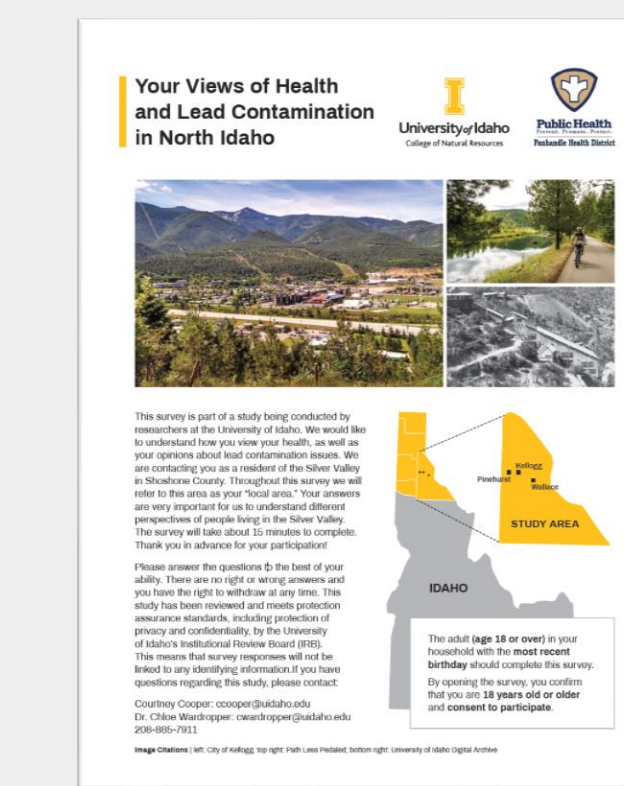


Figure 5. Survey Cover

## Survey Demographics and Descriptive Statistics

Table 1. Overview of Socio-Demographic Variables

Characteristic	Mean (SD) % (Freq)
Age (years, M [SD])	55 (17.7)
Years lived in Silver Valley (years, M[SD])	33 (21.5)
Sex (% [Freq])	
Men	44% (134)
Women	54% (165)
Race/Ethnicity (% [Freq])	
White	91% (278)
Highest education (% [Freq])	
Advanced or College degree	36% (100)
Some college but no degree or less	63% (190)
Occupational status (% [Freq])	
Retired	36% (109)
Working full-time	36% (114)
Working part-time, homemaker, disabled/medical leave	21% (58)
Approximate household income (% [Freq])	
Less than \$50,000	51% (160)
\$50,000 or more	38% (116)
No Response	10% (30)
Family in mining	
Yes	44.4% (136)
No	53.3% (163)

Note. Response categories exclude categories for no response. Categories combined for simplicity. Dark grey boxes distinguish variables used in model.



Figure 6. Example of lead contaminated beach area

In the past 12 months, how often have you completed the following activities related to lead contamination.

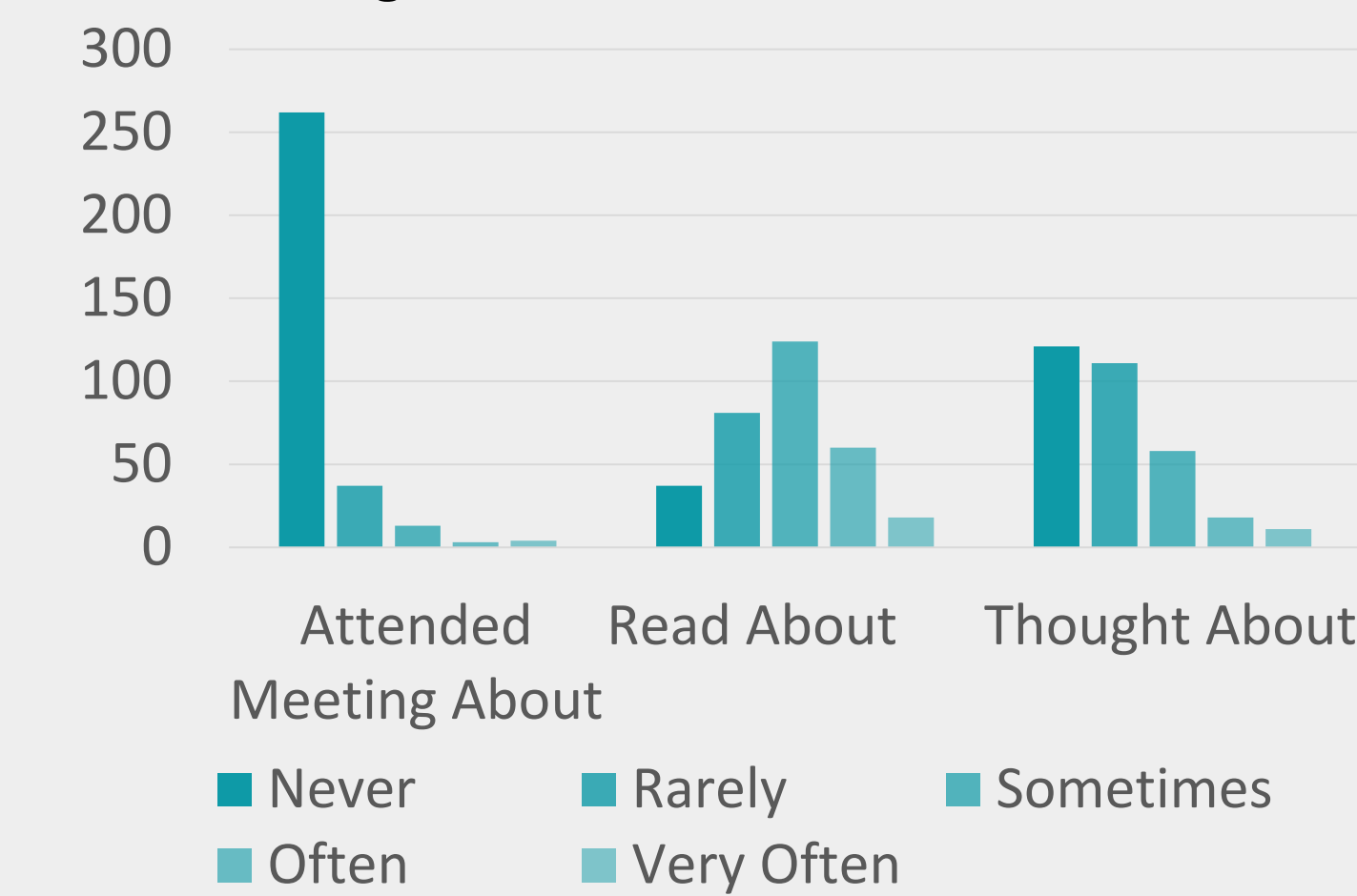


Figure 7. Levels of engagement with lead contamination issues

## Structural Model

Table 2. Overview of Socio-Demographic Variables

Predictor	Dependent Variable	Model 1		Model 2	
		$\beta$ (SE)	p value	$\beta$ (SE)	p value
Benefits	Behavioral Intention	0.54 (0.11)	0.000***	0.61 (0.10)	0.000***
Barriers		-0.04 (0.08)	0.465	-0.06 (0.07)	0.675
Self-Efficacy		0.09 (0.08)	0.199	0.06 (0.06)	0.239
Susceptibility		-0.04 (0.06)	0.567	0.02 (0.05)	0.661
Severity		0.38 (0.11)	0.000***	0.38 (0.07)	0.000***
Sex	Severity			-0.13 (0.11)	0.050
Family in Mining				-0.16 (0.11)	0.014*
Age				-0.14 (0.00)	0.029*
Sex	Susceptibility			-0.02 (0.12)	0.807
Family in Mining				0.15 (0.12)	0.011*
Age				-0.05 (0.00)	0.395
Sex	Benefits			-0.21 (0.08)	0.000***
Family in Mining				-0.09 (0.08)	0.145
Age				-0.06 (0.00)	0.348
Sex	Efficacy			0.07 (0.10)	0.245
Family in Mining				0.12 (0.10)	0.061
Age				0.13 (0.03)	0.041*

Note. \*, \*\*, \*\*\* signify significance at  $p < 0.05$ ,  $p < 0.01$ , and  $p < 0.001$  respectively. 1=Family in mining; 1=Men.

## Structural Model

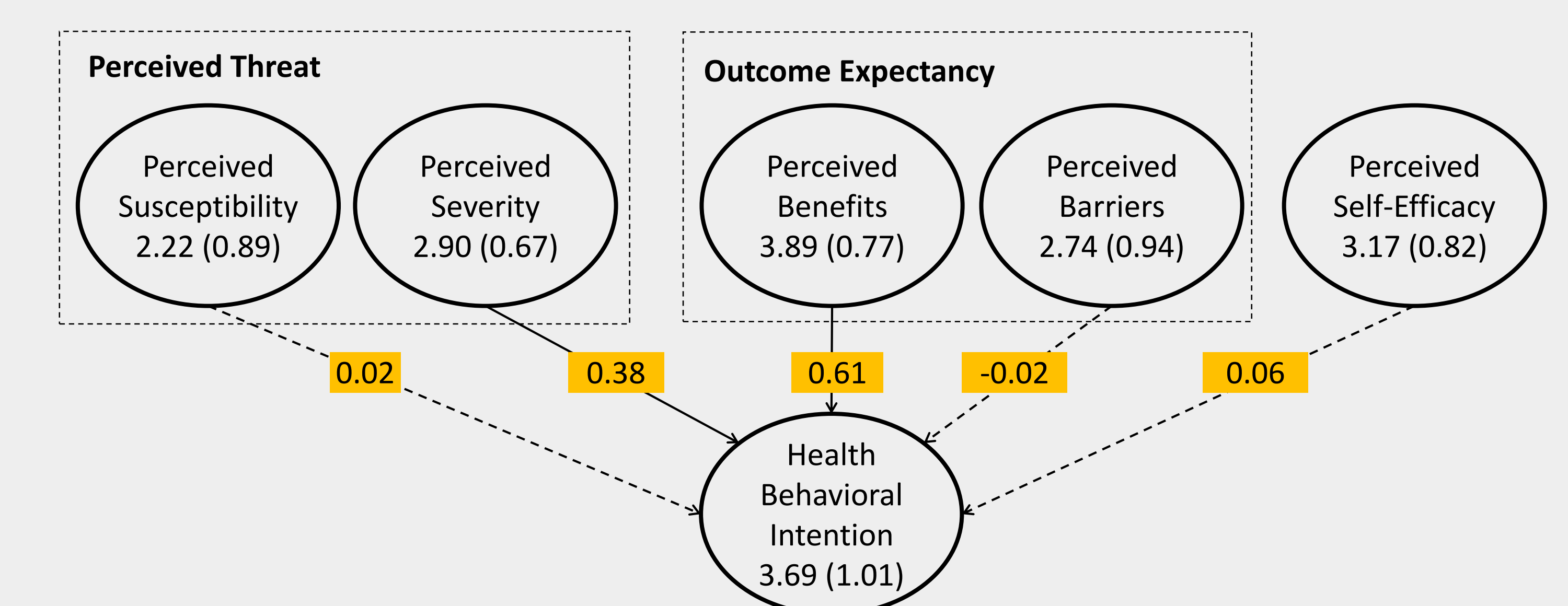


Figure 8. Standardized regression coefficients for model 2. Latent variables (circles) are based on measured variables (1-5 scale); Means and standard deviations reported.

Table 3. Overview of Socio-Demographic Variables

	1	2	3	4	5	6	Mean
1. Barriers ( $\alpha=0.71$ )	--						2.74
2. Benefits ( $\alpha=0.88$ )	-0.10	--					3.89
3. Susceptibility ( $\alpha=0.82$ )	0.16	0.09	--				2.22
4. Severity ( $\alpha=0.88$ )	0.12	0.48***	0.53***	--			2.90
5. Self-Efficacy ( $\alpha=0.90$ )	-0.18	0.08	-0.16	0.45***	--		3.17
6. Behavioral Intention ( $\alpha=0.83$ )	-0.07	0.72***	0.23***	0.57	-0.06	--	3.69

Note. \*\*\* signifies significance at  $p < 0.001$ . Cronbach's Alpha reported to indicate internal validity. Means above 3 under midpoint for scale.

## Discussion

- Respondents infrequently consider lead contamination threats by thinking, reading, or attending community events about it.
- Results align with our proposed associations between behaviors and health beliefs, although associations between several variables were not significant.
- Significant associations between behavioral intention, severity, and benefits
- Non-significant associations between susceptibility, barriers, and self-efficacy and behavioral intention.
- Strong inverse association between self-efficacy and severity.
- Associations between severity, benefits, and behavioral intention were somewhat stronger and more positive for respondents who were female, younger, and did not have family involved in mining.

## Implications for Risk Communication

- Emphasize the benefits of practicing recommended health behaviors while increasing overall perceptions of the severity of the risk
- Focus on promoting the health and safety of women, children, and those whose occupations bring them in close contact with contamination (e.g., miners).
- Prioritize holistic and participatory risk communication strategies.

## Acknowledgements

NIGMS-NIH award #2U54GM104944  
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Figure 9. Revegetated hill slopes around Central Impoundment Area ~2010.

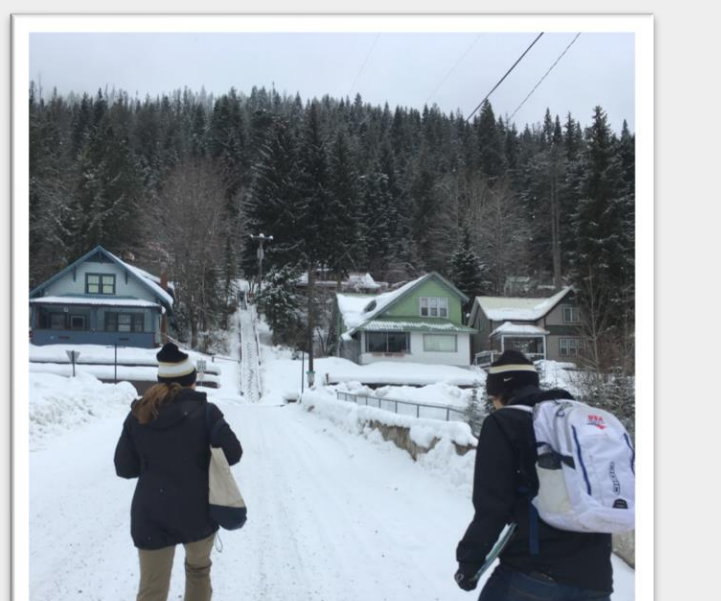


Figure 10. Field staff distributing surveys in Wallace, Idaho

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