

## Hunter Perceptions of Similarity and Trust in Wildlife Agencies and Personal Risk Associated with Chronic Wasting Disease

MARK D. NEEDHAM

Department of Forest Resources, Oregon State University,  
Corvallis, Oregon, USA

JERRY J. VASKE

Human Dimensions of Natural Resources, Colorado State University, Fort  
Collins, Colorado, USA

*Theory suggests that risk perceptions are influenced by trust in managing agencies. Shared goals and values (i.e., perceived similarity) are foundations of trust. This article examines the extent to which hunters perceive personal health risks associated with chronic wasting disease (CWD) (e.g., become ill from CWD) and the influence of perceived similarity and trust in state wildlife agencies as determinants of risk. Data were obtained from surveys (n = 9567) of resident and nonresident deer and elk hunters in eight states. Structural equation models showed that across all strata, hunters' perceptions of similarity with agencies positively influenced trust in agencies to manage CWD, explaining up to 49% of the variance in trust. Hunters who trusted agencies perceived less risk associated with CWD, but trust only explained up to 8% of the variance in risk. Hunters perceived similarity with and trust in wildlife agencies, but still perceived risks associated with CWD.*

**Keywords** chronic wasting disease, hunting, perceived risk, salient value similarity, social trust, structural equation modeling, wildlife management

Chronic wasting disease (CWD) is a neurological disease of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) (Williams et al. 2002; CDOW 2005). CWD is a transmissible spongiform encephalopathy (TSE) disease similar to bovine spongiform encephalopathy in cattle (i.e., mad cow), scrapie in sheep, and Creutzfeldt-Jakob disease in humans (McKintosh et al. 2003). In all infected

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Address correspondence to Dr. Mark D. Needham, Department of Forest Resources, Oregon State University, Corvallis, OR 97331, USA. E-mail: mark.needham@oregonstate.edu

animals, CWD causes emaciation, abnormal behavior, and death (Williams et al. 2002). Although there is no evidence to suggest that CWD poses a human health risk, transmission to humans cannot be completely dismissed (e.g., Belay et al. 2004).

CWD was identified in captive deer and elk in the 1960s and 1970s, and in free-ranging herds in the 1980s and 1990s in Colorado and Wyoming (Spraker et al. 1997; Williams et al. 2002). The disease is also found in free-ranging herds in other parts of the United States and Canada, including Alberta, Kansas, Illinois, Nebraska, New Mexico, New York, Saskatchewan, South Dakota, Utah, West Virginia, and Wisconsin. CWD was recently discovered in free-ranging moose in Colorado (CDOW 2005). In many of these states and provinces, some hunters have stopped hunting because of concerns about CWD (Needham et al. 2004; Vaske et al. 2004).

Theory suggests that hunters' behavior may be influenced by perceptions of risk regarding a hazard such as CWD, and these risk perceptions may be shaped by the extent to which hunters trust the managing agency (Bord and O'Connor 1992; Flynn et al. 1992; Viklund 2003).<sup>1</sup> Shared goals, values, thoughts, and opinions (i.e., perceived similarity) are thought to constitute foundations of this trust. If the agency is perceived as similar to the individual, trust increases and perceived risk declines (Siegrist et al. 2000). This article examines the extent to which hunters perceive personal health risks associated with CWD (e.g., concerns about eating meat from deer or elk that may have CWD, becoming ill from CWD) and the influence of perceived similarity and trust in state wildlife agencies as determinants of this risk.

## Review of Literature

### *Human Dimensions of CWD*

Big game hunting participation per capita has decreased in North America (Heberlein and Thompson 1996; Brown et al. 2000). This decline may be exacerbated by hunters' perceptions of risk regarding CWD (Vaske et al. 2004). Hunting declines attributable to CWD may: (a) reduce revenue from hunting license sales, (b) impact wildlife management and stocking programs if funds get diverted to address CWD, (c) limit an agency's ability to manage game species, (d) erode support of wildlife agencies, and (e) constrain cultural traditions and the socioeconomic stability of communities dependent on hunting (Needham et al. 2004).

Given these potential ramifications, researchers have examined hunters' behavioral intentions in response to CWD. If CWD conditions continue to worsen, states may witness substantial changes in hunter behavior (e.g., hunt in other areas, quit hunting) (e.g., Miller 2004; Vaske et al. 2004). Needham et al. (2004), for example, found that 49% of hunters across eight states reported that they would stop hunting in their state if a majority of deer or elk were infected with CWD. Wisconsin residents who quit hunting deer because of CWD perceived more risk associated with the disease compared to those who continued hunting (Vaske et al. 2004). Little is known, however, about the extent to which (a) hunters think that CWD may pose a personal health risk and (b) hunters' trust in agencies to manage CWD influences these risk perceptions. This article helps to address these knowledge gaps.

### ***Perceived Risk***

Perceived risk is the extent to which individuals believe that they are or may be exposed to a hazard (Thompson and Dean 1996; Sjöberg 2000a). Risk perceptions can influence human decision making and behavior (Fischhoff et al. 1978; Siegrist et al. 2005). Hunters concerned about CWD, for example, may stop hunting or avoid consuming deer, elk, or moose (Miller 2004). Risk perception is subjective and people can differ in judgments (Siegrist et al. 2005). For example, people seldom make the same estimates when assessing risk to themselves (i.e., personal risk) versus society (i.e., societal/general risk); people often believe that they are at less risk than others (Slovic et al. 1981; Sjöberg 2000a).

Various approaches have been used to measure risk perceptions. One method involves assessing the probability or likely occurrence of an event and damage that may be incurred (i.e., consequence) (Thompson and Dean 1996; Sjöberg 1999; McCaffrey 2004). Another approach involves assessing risk characteristics of a hazard (e.g., Slovic 1987; Riley and Decker 2000; Sjöberg 2000a). Fischhoff et al. (1978), for example, found that perceived dread (i.e., how uncontrollable, dangerous) and knowledge (i.e., how old, well-known) about a hazard influenced risk perceptions. This article, however, does not assess the probability or dimensionality of CWD risk; it examines the extent to which hunters perceive that CWD may pose a personal health risk (e.g., concerns about eating deer or elk due to CWD, becoming ill from CWD) and the influence of trust in wildlife agencies to manage the disease as a determinant of this perceived risk.

### ***Social Trust***

Although there are different approaches for measuring risk perceptions (Sjöberg 2002), risk management researchers have demonstrated the importance of social trust as a determinant of perceived risk (e.g., Siegrist and Cvetkovich 2000; Sjöberg 2001; Trumbo and McComas 2003). Training and experience often provide experts with more knowledge about hazards. Lacking this knowledge, public judgments of risks may be based more on trust in experts responsible for managing the hazard than the actual hazard (Siegrist and Cvetkovich 2000).

Social trust is the willingness to rely on those with formal responsibility for making decisions and taking actions related to management of technology, medicine, environment, or other realms of public health and safety (Earle and Cvetkovich 1995; Siegrist et al. 2000). Individuals or agencies being trusted or distrusted may or may not be personally known to the person making the trust attribution (Siegrist et al. 2000).

Trust may be especially important in the absence of knowledge about a hazard (Siegrist et al. 2005). Hunters' knowledge about CWD is low, as demonstrated by survey responses to a series of true/false questions (Vaske et al. 2006). Fewer than 5% of hunters answered all questions correctly; the largest proportion failed to answer more than half correctly.

People who trust agencies in charge of managing a hazard perceive less risk regarding the hazard compared to those who do not trust the agencies (e.g., Bord and O'Connor 1992; Flynn et al. 1992; Siegrist and Cvetkovich 2000; Siegrist et al. 2000, 2001). Examination of the strength of relationships between social trust and perceived risk, however, has provided mixed results. In some studies, up to 70%

of the variance in perceived risk is explained by trust (Flynn et al. 1992; Siegrist et al. 2000). Other studies, however, report that 5% to 20% of risk is explained by trust (e.g., Sjöberg 2000b; Trumbo and McComas 2003; Viklund 2003). Weak to moderate relationships between trust and risk may suggest that people think that there are limits to how much agencies and other experts know. People may trust a managing agency, but believe that risks are beyond agency control (Sjöberg 2001).

There are inconsistencies in the operationalization of social trust. First, variables used in past studies (Siegrist et al. 2000), such as “the responsible authorities accurately control whether legal regulations and restrictions are upheld,” arguably measure perceptions of how well risks are managed by an agency, not the extent to which the agency is trusted (Frewer et al. 2003). Second, the independent (i.e., social trust) and dependent (i.e., perceived risk) variables should be measured at similar levels of contextual specificity (e.g., state wildlife agencies, CWD) for results to be most meaningful (Sjöberg 2001; Viklund 2003). Third, some researchers suggest that trust consists of multiple dimensions such as fairness, caring, competence, and responsibility (e.g., Johnson 1999; Poortinga and Pidgeon 2003). This view presumes that processes underlying social trust are complex and a requisite level of knowledge about a managing agency’s actions is needed to make cognitively detailed judgments of trust (Winter et al. 1999; Siegrist et al. 2000).

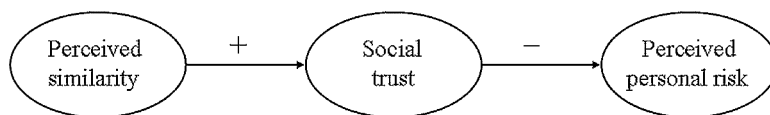
### *Perceived Similarity*

An alternative view proposes that social trust consists of either trust or distrust (Winter et al. 1999; Siegrist 2000; Siegrist and Cvetkovich 2000; Siegrist et al. 2000, 2001; Cvetkovich and Winter 2003). The public often lacks the knowledge or time to make complex trust attributions (Earle and Cvetkovich 1995). Decisions regarding whether to trust an agency involve a link between perceptions of the agency and trust in its actions (Winter et al. 1999; Siegrist 2000). Trust is influenced by shared goals, values, and opinions. People often trust agencies that are perceived to share similar views (Siegrist et al. 2000; Cvetkovich and Winter 2003).

Researchers who take this view suggest that social trust is based on perceived similarity rather than on carefully reasoned attributions of trust or direct knowledge of the managing agency (Earle and Cvetkovich 1995; Siegrist et al. 2000, 2001). People base trust judgments on whether they believe that the agency shares similar goals, values, thoughts, and opinions. This approach is known as salient value similarity, but has also been referred to as attributes of salient similarity, perceived shared values, and perceived similarity (e.g., Siegrist et al. 2000, 2001; Cvetkovich and Winter 2003).

Perceived similarity frequently predicts social trust; people who perceive that they share views similar to those of the managing agency tend to trust the agency more than those who do not (e.g., Siegrist et al. 2000; Cvetkovich and Winter 2003; Poortinga and Pidgeon 2003; Walls et al. 2004). Trust in agencies managing endangered species and recreation user fees, for example, was highly correlated with judgments of similarity (Winter et al. 1999; Cvetkovich and Winter 2003). Multiple-item semantic differential (Siegrist et al. 2000) or agree/disagree (Poortinga and Pidgeon 2003) scales are typically used for measuring this concept (e.g., thinks like me-thinks unlike me, shares similar values as me).

Relationships among perceived similarity, social trust, and risk have received attention in the risk analysis literature. Siegrist et al. (2000), for example, collected



**Figure 1.** Hypothesized model for hunters' perceptions of personal risk associated with CWD (Needham 2006). The "+" refers to a positive relationship between similarity and trust; the "-" refers to a negative relationship between trust and risk.

data from students and used structural equation modeling to examine relationships among these three factors for pesticides, artificial sweeteners, and nuclear power. Substantial positive relationships between similarity and trust and negative relationships between trust and risk were observed. Perceived similarity led to higher social trust, which led to lower perceptions of risk (Figure 1).

Although the concepts of similarity, trust, and risk have individually received attention in the natural resource literature (e.g., Riley and Decker 2000; Cvetkovich and Winter 2003; Winter et al. 1999, 2004), little research has examined these three concepts within the context of CWD and its management (Vaske et al. 2004). One objective of this article, therefore, is to examine the extent to which hunters perceive personal health risks associated with CWD (e.g., concerns about eating deer or elk meat, becoming ill due to CWD) and trust wildlife agencies to manage this disease. A second objective is to examine relationships among perceived similarity, social trust, and personal risk related to CWD using the three-factor model (Figure 1) applied and tested in the risk analysis literature (Siegrist et al. 2000, 2001). Based on this literature, the following hypotheses are advanced (Figure 1):

- H<sub>1</sub>: There will be a positive relationship between perceived similarity and social trust. Hunters who perceive that they share goals, thoughts, and opinions similar to those of the agency will be more likely to trust the agency to manage CWD compared to those who do not share similar views.
- H<sub>2</sub>: There will be a negative relationship between social trust and personal risk. Hunters who trust the agency to manage CWD will be less likely to perceive that the disease poses a personal health risk compared to those who do not trust the agency.

## Methods

Data for this article were drawn from a larger study designed to develop a baseline understanding of various aspects of hunters' responses to CWD, especially changes in hunting participation and acceptance of management alternatives (Needham et al. 2005). Data were obtained from a mail survey of resident and nonresident deer hunters in eight states (Arizona, Colorado, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming) and elk hunters in three states (Colorado, Utah, Wyoming), yielding a total of 22 strata (Table 1). CWD had been found in free-ranging deer and/or elk in each of these states except Arizona and North Dakota. Each state's wildlife/fish and game agency provided names and addresses of random samples of hunters 18 years of age and older who purchased a license to hunt deer or elk with a firearm in 2003.<sup>2</sup>

**Table 1.** Completed questionnaires and response rates for each stratum

Strata	Mailed	Undeliverable	Completed ( <i>n</i> )	Response rate (%)
Arizona nonresident deer hunters	988	37	444	47
Arizona resident deer hunters	1025	36	396	40
Colorado nonresident deer hunters	1025	13	509	50
Colorado resident deer hunters	1025	41	459	47
Colorado nonresident elk hunters	1025	17	564	56
Colorado resident elk hunters	1025	34	472	48
Nebraska nonresident deer hunters	1025	17	524	52
Nebraska resident deer hunters	1025	13	423	42
North Dakota nonresident deer hunters	1025	23	509	51
North Dakota resident deer hunters	1025	23	346	35
South Dakota nonresident deer hunters	1025	10	557	55
South Dakota resident deer hunters	1025	10	423	42
Utah nonresident deer hunters	1025	47	439	45
Utah resident deer hunters	1025	45	328	34
Utah nonresident elk hunters	832	51	337	43
Utah resident elk hunters	1025	73	331	35
Wisconsin nonresident deer hunters	1025	80	465	49
Wisconsin resident deer hunters	1025	30	378	38
Wyoming nonresident deer hunters	1025	19	475	47
Wyoming resident deer hunters	1025	79	308	33
Wyoming nonresident elk hunters	1025	18	506	50
Wyoming resident elk hunters	1025	57	374	39
Total	22,320	773	9567	44

Three mailings were used to administer 16-page questionnaires beginning at the end of July 2004. Hunters were initially mailed a questionnaire, postage-paid return envelope, and cover letter explaining the study. Reminder postcards were sent to nonrespondents approximately two weeks after the initial mailing. A second complete mailing (i.e., questionnaire, return envelope, cover letter) was sent to nonrespondents approximately three weeks after the postcard reminder.

Questionnaires were mailed to 22,320 hunters. With the exception of Arizona nonresident deer hunters and Utah nonresident elk hunters, 1025 hunters in each stratum were sent a questionnaire (Table 1). For these other two strata, the full

population of hunters was mailed a questionnaire because fewer than 1025 licenses were sold. Across all 22 strata, 773 questionnaires were undeliverable (e.g., incorrect address, moved) and 9567 completed questionnaires were returned, yielding a 44% overall response rate (9567/22,320-773). Among the strata (Table 1), sample sizes ranged from 308 (33% response rate, Wyoming resident deer hunters) to 564 (56% response rate, Colorado nonresident elk hunters).

To check for nonresponse bias, hunters who completed a questionnaire were compared to those who did not. A sample of 785 nonrespondents was telephoned in November 2004 and asked nine questions from the questionnaire. Responses to these questions were examined for differences between respondents and nonrespondents for each of the 22 strata (Table 1). In total, only 31 of 198 (16%) tests for differences between respondents and nonrespondents (22 strata  $\times$  9 questions = 198 tests) were statistically significant at  $p < .05$ ; 21 of these tests were for questions unrelated to this article, as they addressed hunter participation in response to CWD and concerns about deer or elk health due to CWD (Needham et al. 2005). Only 10 of 198 tests (5%) showed statistical differences for questions examined in this article (e.g.,  $V_5$ ,  $V_{11}$ ,  $V_{14}$  in Table 2). This small percentage of significant differences between respondents and nonrespondents is within statistical probabilities of occurring by chance (Cohen 1988). Effect sizes ( $V$ ,  $r_{pb}$ ) ranged from .01 to .24 and averaged .09. Using guidelines from Cohen (1988) and Vaske et al. (2002), these effect sizes suggest that the strength of any differences between respondents and nonrespondents was "weak" or "minimal." Taken together, findings suggest that nonresponse bias was not a problem for this article so data were not weighted.<sup>3</sup>

Variables and response scales used to measure perceived similarity, social trust, and personal risk are provided in Table 2. The respective agency name (e.g., Colorado Division of Wildlife, Nebraska Game and Parks Commission) was included in variables measuring similarity and trust. Variables and scales measuring perceived similarity are identical to past research (e.g., Winter et al. 1999; Siegrist et al. 2000; Poortinga and Pidgeon 2003). Social trust and personal risk variables and scales are also similar to those used in earlier studies (e.g., Cheron and Ritchie 1982; Flynn et al. 1992; Vaske et al. 2004; Winter et al. 2004).

For each stratum, mean responses for each variable revealed the extent to which hunters perceived similarity with and trust in the agency and personal risk associated with CWD. Internal consistency of the perceived similarity, trust, and risk concepts was examined using Cronbach alpha reliability coefficients. Confirmatory factor analysis was performed for each stratum to test whether variables measuring each latent concept (i.e., similarity, trust, risk) provided a good fit. Structural equation modeling was used to test the hypotheses for each stratum. This approach is consistent with studies examining relationships among similarity, trust, and risk (e.g., Siegrist et al. 2000). EQS 6.1 software and Satorra-Bentler robust estimation to correct for multivariate nonnormality were used because data skewness and kurtosis indicated violations of the normal distribution assumption (Byrne 1994; Chou and Bentler 1995). Robust corrected (\*) comparative fit index (CFI\*), non-normed fit index (NNFI\*), and root mean square error of approximation (RMSEA\*) assessed model fit. CFI\* and NNFI\* values  $\geq .90$  and RMSEA\* values  $\leq .08$  suggest acceptable fit (Browne and Cudeck 1993). Robust standard errors were used for test statistics.

**Table 2.** Summary of variable/item means, factor loadings, and concept reliabilities

Concepts and variables	Item code	Mean responses ( <i>M</i> )		Factor loadings <sup>a</sup>		Cronbach Alpha
		Range	Average	Range	Average	
Perceived similarity—I feel the (state wildlife agency) <sup>b</sup> ;						.94-.97
Shares similar values as me	V <sub>1</sub>	4.1-5.6	5.2	.85-.92	.89	
Shares similar opinions as me	V <sub>2</sub>	4.0-5.3	4.9	.86-.96	.92	
Shares similar goals as me	V <sub>3</sub>	4.1-5.4	5.1	.84-.91	.89	
Thinks in a similar way as me	V <sub>4</sub>	3.8-5.2	4.8	.90-.95	.92	
Takes similar actions as I would	V <sub>5</sub>	3.7-5.2	4.7	.81-.91	.86	
Social trust—I trust the (state wildlife agency) to <sup>b</sup> ;						.94-.97
Provide the best available information on CWD issues	V <sub>6</sub>	4.7-5.9	5.5	.84-.92	.89	
Provide enough information to decide actions to take regarding CWD	V <sub>7</sub>	4.7-5.9	5.4	.86-.94	.90	
Provide truthful information about human safety related to CWD	V <sub>8</sub>	4.8-5.9	5.6	.86-.93	.90	
Provide timely information regarding CWD issues	V <sub>9</sub>	4.6-5.8	5.4	.88-.94	.92	



Make good deer/elk management decisions regarding CWD issues	V <sub>10</sub>	4.5–5.7	5.3	.78–.91	.86
Properly address CWD in (state)	V <sub>11</sub>	4.5–5.7	5.4	.79–.92	.89
Perceived personal risk					.77–.85
Inadvertently eating meat from an animal infected with CWD <sup>c</sup>	V <sub>12</sub>	3.2–4.0	3.6	.74–.89	.83
Becoming ill as a result of contracting a disease caused by CWD <sup>c</sup>	V <sub>13</sub>	2.9–3.8	3.3	.86–.96	.91
Because of CWD, how concerned are you about your own health <sup>d</sup>	V <sub>14</sub>	3.1–3.9	3.5	.58–.73	.65
Because of CWD, I have concerns about eating deer/elk meat <sup>b</sup>	V <sub>15</sub>	3.8–4.6	4.2	.42–.64	.53

*Note.* Range represents lowest to highest means, factor loadings, and Cronbach alpha reliability coefficients among all 22 strata. Average represents the mean across all strata. Individual item statistics for each of the 22 strata are reported in Needham (2006).

<sup>a</sup>Confirmatory factor analyses based on Satorra-Bentler robust estimation for multivariate nonnormality. All loadings are standardized and significant at  $p < .001$ . Range of measurement model fit indices: NNFI = .89 to .94, CFI\* = .90 to .95, RMSEA\* = .06 to .09.

<sup>b</sup>Variables coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

<sup>c</sup>Variables coded on 9-point scale: 1–2 = no risk, 3–4 = slight risk, 5–7 = moderate risk, 8–9 = extreme risk.

<sup>d</sup>Variable coded on 9-point scale: 1–2 = not concerned, 3–4 = slightly concerned, 5–7 = moderately concerned, 8–9 = extremely concerned.

## Results

### *Descriptive Findings*

On average, hunters in each state slightly to moderately agreed that they shared similar values, opinions, goals, actions, and thoughts as the state wildlife agencies (Table 2). Across all strata, hunters also agreed that they trusted these agencies to manage CWD. Mean ratings for the trust variables ranged from 4.5 (slightly agree) to 5.9 (moderately agree). On average, hunters in all strata thought they were slightly at risk of consuming meat from animals infected with CWD and becoming ill from the disease. Hunters were concerned about their health because of CWD, but neither agreed nor disagreed that they were concerned about consuming deer or elk due to CWD.

### *Measurement Models*

Confirmatory factor analysis for each stratum demonstrated that the data provided an acceptable fit for the three concepts. Table 2 shows the standardized factor loadings associated with each multi-item concept. Factor loadings ranged from .81 to .96 for variables measuring perceived similarity, .78 to .94 for social trust, and .42 to .96 for risk perception. All loadings were significant at  $p < .001$ . Reliability coefficients indicated high internal consistency, ranging from .94 to .97 for similarity and trust, and .77 to .85 for risk. Deletion of any variable from its respective concept did not improve reliability. CFI\* (.90 to .95), NNFI\* (.89 to .94), and RMSEA\* (.06 to .09) indicated acceptable measurement model fit for each stratum.

### *Structural Models*

For all 22 strata, overall structural model fit was acceptable. Structural fit indices ranged from .89 to .95 for CFI\* and NNFI\*, and .06 to .09 for RMSEA\* (Table 3). As predicted by Hypothesis 1, a positive relationship between perceived similarity and social trust was observed across all 22 strata (Table 3). Standardized coefficients ranged from  $\beta = .45$  to .70 and were significant at  $p < .001$  for all strata. Hunters' perceptions of similarity with the wildlife agencies explained between 21% and 49% of the variance in trust of these agencies to manage CWD. Across all strata (i.e., state, residency, species hunted), hunters who perceived that they shared goals, thoughts, and opinions similar to those of the state wildlife agencies were more trusting of these agencies to manage CWD than those who perceived that they did not share similar views.

A negative relationship between social trust and personal risk was found across all 22 strata (Table 3). Standardized coefficients ranged from  $\beta = -.01$  to  $-.28$  and were statistically significant for 14 strata ( $p < .05$  or  $p < .001$ ). Hunters' trust in agencies to manage CWD explained 8% or less of the variance in perceptions of risk associated with the disease. These findings partially support Hypothesis 2. For most strata, hunters who trusted wildlife agencies to manage CWD were less likely to perceive that the disease posed a personal health risk compared to those who were less trusting, but there are clearly additional attributes that influence this risk.<sup>4</sup>

**Table 3.** Summary of structural model analyses and fit indices for each stratum

Strata	Perceived similarity → Social trust		Social trust → Personal risk		R <sup>2</sup>	NNFI*	CFI*	RMSEA*
	$\beta$	R <sup>2</sup>	$\beta$	R <sup>2</sup>				
Arizona nonresident deer hunters	.63***	.40	-.06	.00	.90	.91	.08	
Arizona resident deer hunters	.50***	.25	-.21***	.05	.91	.92	.08	
Colorado nonresident deer hunters	.47***	.22	-.25***	.06	.91	.92	.07	
Colorado resident deer hunters	.65***	.42	-.05	.00	.92	.94	.08	
Colorado nonresident elk hunters	.54***	.29	-.28***	.08	.92	.94	.07	
Colorado resident elk hunters	.63***	.40	-.11*	.02	.93	.94	.07	
Nebraska nonresident deer hunters	.62***	.38	-.14*	.02	.89	.90	.09	
Nebraska resident deer hunters	.61***	.37	-.14*	.02	.93	.94	.07	
North Dakota nonresident deer hunters	.60***	.36	-.01	.00	.93	.94	.07	
North Dakota resident deer hunters	.52***	.27	-.02	.00	.95	.95	.06	
South Dakota nonresident deer hunters	.45***	.21	-.16*	.03	.89	.91	.09	
South Dakota resident deer hunters	.56***	.32	-.14*	.02	.91	.93	.08	
Utah nonresident deer hunters	.56***	.31	-.08	.01	.91	.93	.08	
Utah resident deer hunters	.64***	.40	-.11*	.02	.93	.94	.08	
Utah nonresident elk hunters	.61***	.37	-.13*	.02	.93	.95	.07	
Utah resident elk hunters	.65***	.43	-.03	.00	.93	.94	.08	
Wisconsin nonresident deer hunters	.66***	.44	-.11*	.02	.91	.92	.08	
Wisconsin resident deer hunters	.70***	.49	-.07	.01	.94	.95	.08	
Wyoming nonresident deer hunters	.63***	.39	-.19***	.04	.91	.93	.07	
Wyoming resident deer hunters	.68***	.46	-.04	.00	.92	.94	.08	
Wyoming nonresident elk hunters	.50***	.25	-.13*	.02	.89	.90	.09	
Wyoming resident elk hunters	.67***	.45	-.16*	.03	.94	.95	.07	

Note. Based on Satorra-Bentler robust estimation for multivariate nonnormality;  $\beta$  = standardized path coefficients; \*  $p < .05$ , \*\*\*  $p < .001$ .

## Discussion

Theory suggests that risk perceptions are influenced by trust in managing agencies, and shared goals, values, and opinions are foundations of this trust (e.g., Siegrist et al. 2000). This article generally supported these conceptual relationships. Consistent with Hypothesis 1, hunters' perceptions of similarity with state wildlife agencies positively influenced trust in these agencies to manage CWD, explaining up to 49% of the variance in trust. Hypothesis 2 predicted that hunters who trust agencies to manage CWD perceive less risk associated with the disease. This was supported across most strata, but trust only explained up to 8% of the variance in risk. Hunters perceived slight to moderate similarity with and trust in the agencies, but still perceived personal risk related to CWD. Findings have implications for management, theory, and research.

### *Management Implications*

From an applied perspective, results showed relatively weak but consistently negative relationships between trust in wildlife agencies and perceived risk associated with CWD. Studies of other issues such as nuclear power have shown much stronger relationships between trust and risk (Flynn et al. 1992; Siegrist et al. 2000). Nuclear power, however, is a technology created and controlled by humans, whereas CWD is a naturally occurring wildlife disease that continues to spread to new locations (Miller et al. 2004). Natural risks are sometimes perceived as more uncontrollable and random (i.e., higher risk) than anthropogenic risks (e.g., Sjöberg 2000a; Zinn and Pierce 2002; McCaffrey 2004). Perhaps hunters trust state wildlife agencies to manage CWD, but believe that there are limits to how much these agencies know and that potential risks associated with this disease are largely beyond agency control. To mitigate hunters' risk perceptions associated with CWD, agencies may need to do more to inform and educate hunters about strategies for managing the disease (e.g., CWD testing, herd reduction).

Findings also revealed that, on average, hunters agreed that they shared views similar to those of wildlife agencies and trusted them to manage CWD. This is important for several reasons. First, similarity and trust can influence support of agency goals and objectives (Vaske et al. 2004). For example, hunters who trust wildlife agencies may be more likely to support management actions such as CWD testing and herd reduction (Needham et al. 2004; Vaske et al. 2006).

Second, persuasion models (e.g., elaboration likelihood, heuristic systematic) suggest that perceived similarity and trust may be important determinants of effective communication and persuasion campaigns (e.g., Chaiken et al. 1996). Hunters who trust a wildlife agency may be more motivated to attend to its information about CWD. Campaign effectiveness may be lower with hunters who are less trusting of wildlife agencies.

Third, trust had an influence, albeit minor, on hunters' risk perceptions regarding CWD. Research has shown that perceived CWD risk can influence hunters to stop hunting (Vaske et al. 2004). Given the potential consequences of hunting declines attributable to CWD (e.g., revenue loss, management impacts), agencies should maintain trust by fostering positive relationships and dialogue with hunters (Needham et al. 2004; Vaske et al. 2006).

Fourth, agencies should strive to understand constituents' opinions, values, and goals (Manfredo et al. 2003). To preserve trust and a strong constituent base,

management should be tailored to reflect these views whenever practical and feasible. If constituents' views are not reflected in management, reasons for inconsistencies should be shared so they can be weighed in relation to considerations of trust (Cvetkovich and Winter 2003).

Despite relatively high trust in state wildlife agencies, many hunters are concerned about their health because of CWD and think that they are at risk of becoming ill from the disease and consuming meat from infected animals. Perhaps hunters are concerned about CWD because it is similar to related diseases that can cause human death (e.g., Creutzfeldt-Jakob) (McKintosh et al. 2003). Findings contradict most agency information and education campaigns stating that there is no evidence that CWD poses a human health risk (World Health Organization 2000). Differences between CWD and related diseases and the lack of evidence showing a connection between CWD and human health problems should be reiterated and emphasized by agencies.

These messages suggesting no link between CWD and human health, however, also advise hunters to behave as though a risk may be present by taking precautions such as testing animals for CWD and wearing gloves when processing animals. This ambiguity in the messages may cause hunters to attend more to one part of the message than the other, which may influence risk perceptions. Hunters may also believe that mixed messages suggest that wildlife agencies are uncertain about CWD, which may influence trust and risk evaluations. Although agencies are likely to communicate precautionary messages primarily for legal reasons, they should take these issues into consideration when developing CWD communication campaigns (Vaske et al. 2006). Research is needed to examine the influence of CWD messages on risk and trust evaluations.

### *Theoretical Implications*

From a theoretical perspective, the finding of substantial positive relationships ( $\beta = .45$  to  $.70$ ) between perceived similarity and social trust was consistent with past research. Siegrist et al. (2000), for example, reported comparable results ( $\beta = .58$  to  $.64$ ). Researchers should continue examining measures of perceived similarity, as they seem to be important determinants of social trust. Given their high factor loadings and reliabilities, variables used here and in other studies appear to be appropriate for measuring perceived similarity.

The relationship between social trust and personal risk is less clear. Some studies have reported strong negative relationships between these concepts (Flynn et al. 1992; Siegrist et al. 2000). Findings here, however, are consistent with research reporting relatively weak but systematically negative relationships (e.g., Sjöberg 2000b, 2001; Viklund 2003). Winter et al. (2004), for example, found only weak to moderate relationships between perceptions of agency trust and risk related to wildfire management approaches. Given that most of the variance in perceived CWD risk remains unexplained by trust in managing agencies, it is possible that other risk attributes such as knowledge, control, dread, and newness may also contribute to perceptions of risk related to this disease (e.g., Fischhoff et al. 1978; Riley and Decker 2000; Sjöberg 2000a).

Findings showed striking similarity across states and other strata (i.e., residency, species) in hunters' perceptions of similarity, trust, and risk. CWD prevalence and management, however, differ among states. Perhaps hunters' risk judgments are

similar across states because hunters recognize that CWD transcends borders and continues to be discovered in new locations. This may be especially true in Arizona and North Dakota where CWD has not yet been detected. Perhaps hunters in these two states were equally concerned about CWD as hunters in states where the disease has been found because both Arizona and North Dakota neighbor states with CWD (e.g., New Mexico, South Dakota, Utah). Findings here begin to generalize across states and strata, highlighting the value of researching issues on a regional scale whenever possible.

### ***Future Research***

To increase the generalizability of these findings, the following research considerations are offered. First, this article examined hunters' perceived health risks associated with CWD (e.g., become ill from CWD); not examined were risks that hunters may perceive for family members, other hunters, or the general public. People sometimes believe that they are at less risk than others (e.g., smoking, wearing seatbelts), which is called risk denial (Slovic et al. 1981; Sjöberg 2000a). This study also did not examine other risks associated with CWD (e.g., risk of losing opportunities to hunt a healthy animal). Research is needed to examine other CWD risks and whether hunters make similar risk estimates for themselves versus others.

Second, this article investigated hunters' perceptions of similarity, trust, and risk. Research has shown that experts (e.g., scientists, agencies), constituent/interest groups, and the public can differ in their perceptions. Experts, for example, sometimes judge risks differently and as less severe compared to nonexperts (Sjöberg 1999). Researchers should consider exploring possible differences in CWD risk judgments among various stakeholder groups.

Third, most studies investigating relationships among similarity, trust, and risk have focused on the limited number of agencies that are usually responsible for managing a hazard. This scope, however, may be too narrow. Risk perceptions may be influenced by additional sources such as interest groups, media, friends, and family. Perhaps this may partially explain the mixed results in studies examining relationships between trust and risk (Siegrist et al. 2000; Viklund 2003; Walls et al. 2004). Effects of other diverse information sources on judgments of risk related to CWD and other natural resource issues warrant research attention.

Fourth, hunters' perceptions of CWD risk were only partially influenced by trust in wildlife agencies to manage the disease. Researchers have identified other determinants of perceived risk including dread, knowledge, control, and newness (e.g., Fischhoff et al. 1978; Slovic 1987; Sjöberg 2002). Riley and Decker (2000), for example, found that factors such as dread and voluntariness were related to risk perceptions associated with cougars. Sjöberg (2002) suggested that risk sensitivity, the predisposition to rate all risks as large, also influences risk perceptions. Questions were not asked to determine these possible dimensions of hunters' perceptions of CWD risk. Research is required to explore the dimensionality of CWD risk.

Fifth, the variables measuring social trust primarily focused on hunters' trust in the agencies to provide CWD information and manage the disease. Future research, however, should consider additional dimensions that may influence hunters' trust in agencies to address CWD (e.g., trust agencies to provide accurate and timely CWD test results, eradicate CWD by reducing herds) and the extent to which results may be similar or different to those observed here.

Sixth, to improve understanding of the human dimensions of CWD, objectives of this article were to (a) examine the extent to which hunters perceive risks associated with CWD and trust agencies to manage the disease and (b) apply a model from the risk analysis literature to examine relationships among similarity, trust, and risk related to CWD (e.g., Siegrist et al. 2000). Other concepts (e.g., attitudes, norms, demographics) have received attention in the natural resource literature and may be related to trust and risk (e.g., Zinn and Pierce 2002; Manfredo et al. 2003) but are beyond these objectives, and most were not included in the questionnaire because it primarily examined changes in hunting participation and acceptance of management alternatives in response to CWD (Needham et al. 2005). Researchers, for example, have found differences in risk judgments between males and females (Flynn et al. 1994). Consistent with other studies of hunters (e.g., Brown et al. 2000), however, fewer than 5% of respondents were female, and small sample sizes for females in each stratum limit the ability to accurately compare males and females in their perceptions of similarity and trust in agencies and risk related to CWD.<sup>5</sup> Research is required, therefore, to examine other potential determinants and correlates of social trust and personal risk in the context of CWD and other natural resource issues.

Finally, the concepts of perceived similarity, trust, and risk have generated considerable interest in the literature. Given the contentious nature of natural resource management issues such as CWD, continuing to draw on the risk literature may facilitate a better understanding of challenges faced by resource managers. Researchers are encouraged to address research needs identified here and improve understanding of the human dimensions of CWD and other wildlife diseases.

## Notes

1. Most risk perception studies involve technologies or activities that have both benefits and negative consequences (e.g., nuclear power provides electricity, but accidents harm humans). Hazards have no obvious benefits (Slovic 1987; Sjöberg 2000a). Given that CWD is always fatal in animals and is similar to TSE diseases that can cause human death, few hunters would likely contend that CWD has benefits. CWD, therefore, is considered a hazard in this article.
2. The questionnaire was pretested in each state in 2003 with hunters who purchased a license to hunt in 2002 ( $n = 659$ ). Details are reported in Needham et al. (2004). Potential overlap of strata (e.g., deer hunters who also hunted elk, hunted in more than one state) was minimized by deleting duplicate cases in samples across strata before questionnaire administration. This study was supported by the Western Association of Fish and Wildlife Agencies (WAFWA). Arizona and North Dakota belong to WAFWA and do not have CWD, but are surrounded by regions with CWD (e.g., New Mexico, Saskatchewan, South Dakota, Utah).
3. Ancillary analyses revealed no substantive differences in results presented in this article between data that were weighted and not weighted based on the nonresponse bias check.
4. In addition to tests of direct effects, mediation analyses were conducted (Baron and Kenny 1986). Mediation was not present in 21 of the 22 strata, as the predictor (similarity) was not related significantly to the criterion (risk). Social trust fully mediated the relationship between similarity and risk for Colorado nonresident elk hunters, but the significant initial relationship between the predictor and criterion was weak,  $\beta = -.09$ ,  $t = 2.07$ ,  $p = .05$ ,  $R^2 = .01$ . Mediation, therefore, was generally not present in this study. For most strata, similarity had a direct effect on trust, which had a direct effect on risk. Similarity was not significantly related to risk.
5. Ancillary analyses revealed no bivariate differences between males and females in each stratum for variables measuring similarity, trust, and risk,  $p > .05$ ,  $r_{pb} < .11$  (Table 2).

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