How Trust and Risk Perception Affect Household Water Use

FREE

Raymond Yu Wang, Center for Social Sciences, Southern University of Science and Technology and Xiaofeng Liu, Department of Geography, University of Hong Kong

https://doi.org/10.1093/acrefore/9780190632366.013.164
Published online: 29 November 2021

Summary

Household water use accounts for an important portion of water consumption. Notably, different households may behave differently regarding how water is used in everyday life. Trust and risk perception are two significant psychological factors that influence water use behavior in households. Since trust and risk perception are malleable and subject to construction, they are useful for developing effective demand management strategies and water conservation policies. The concepts of trust and risk perception are multidimensional and interconnected. Risk perception varies across social groups and is often shaped by subjective feelings toward a variety of activities, events, and technologies. Risk perception is also mediated by trust, which involves a positive expectation of an individual, an organization, and/or an institution that derives from complex processes, characteristics, and competence. Likewise, different social groups' trust in various entities involved in household water use is subject to the significant and far-reaching impact of risk perception. The complexity of the two notions poses challenges to the measurement and exploration of their effects on household water use. In many cases, risk perception and trust can influence people's acceptance of water sources (e.g., tap water, bottled water, recycled water, and desalinated water) and their conservation behavior (e.g., installing water-saving technologies and reducing water consumption) in household water use. Trust can affect household water use indirectly through its influence on risk perception. Moreover, trust and risk perception in household water use are neither given nor fixed; rather, they are dynamically determined by external, internal, and informational factors. A coherent, stable, transparent, and fair social and institutional structure is conducive to building trust. However, trust and risk perception differ among groups with diverse household and/or individual demographic, economic, social, and cultural characteristics. Direct information from personal experiences and, more importantly, indirect information from one's social network, as well as from mass media and social media, play an increasingly important role in the formation and evolution of trust and risk perception, bringing a profound impact on household water use in an era of information. Future directions lie in new dynamics of risk perception and trust in the era of information explosion, the coevolution mechanism of risk perception and trust in household water use, the nuanced impacts of different types of risks (e.g., controllable and uncontrollable) on household water use, and the interactive relations of risk perception and trust across geographical contexts.

Keywords: household water use, trust, risk perception, demand management, water conservation

Subjects: Environmental Health

Introduction

Household water use has increasingly emerged as a focal point of water governance. The scope of household water use includes not only drinking water but also water for other daily uses, such as toilet flushing, showering, and watering gardens. In addition, household water use can be understood in both quality and quantity manners. It can refer to, first, the decisions and behavior of urban and rural households on alternative water source choices (Doria de Franca, 2006; Ross et al., 2014) and, second, the willingness and action to conserve water consumption (Figueroa & Kincaid, 2010; Jorgensen et al., 2009). The former includes people's preferences for tap or bottled water, as well as their acceptance of unconventional water sources, such as reused, recycled, and desalinized water. The latter determines whether people are willing to behave in a way that reduces water consumption in their everyday life, such as installing water-saving devices (e.g., dual-flush toilets), buying water-saving household appliances (e.g., washing machines), turning off the tap while brushing their teeth, shortening their showers, and so on. They reflect how people respond to water demand management strategies (Brooks, 2006; Tortajada et al., 2019) and water conservation policies (Kenney et al., 2008). One important task of facilitating effective water governance is to understand how different factors may influence household water use. Although several studies have examined the effects of economic factors (e.g., water pricing and government rebate programs) (Bennear et al., 2013; Lu et al., 2019), a growing body of literature has emphasized the significance of social and psychological impact, particularly trust and perceptions of risks, on decisions and behavior associated with household water use (Fielding et al., 2012; Zhang & Brown, 2005).

Trust and risk perception are psychological notions derived from subjective ideas. In household water use, trust can be defined as people's confidence in water and in individuals, organizations, or institutions involved in water use processes (e.g., water supply, water treatment, and water recycling). Risk perception refers to people's subjective evaluation about the quantity and quality of household water supply, as well as on potential risks caused by their water use behavior, or whether household water provision is sufficient and safe (Anadu & Harding, 2000; Spence & Walters, 2012). Both concepts are important for household water use studies, as household water use behavior is not purely determined by the awareness of real or objective risks but largely constructed by people's subjective beliefs and perceptions of risks (Renner et al., 2008). First, risk perceptions play a powerful role in shaping household water use behavior because people are more frequently motivated to avoid mistakes, instead of aiming to maximize utility (Vincent-Wayne, 1999). Inspecting risk perception can help people evaluate risk in more holistically and then take responsive measures to prevent or alleviate social crises. Second, trust influences household water use behavior through peoples' beliefs about information provided on water supply and safety, as well as their confidence in the reliability and capability of water-associated actors, representatives, and authorities (Driedger et al., 2013). Trust can affect household water use

decisions, usually by mediating risk perception, and people tend to form their attitudes and act according to the information provided by those authorities or delegates whom they regard as trustworthy. Trust is important because it enables cooperative behavior, reduces negative conflicts, lowers transaction costs, and promotes effective reactions when facing crisis (Rousseau et al., 1998). A high level of trust thus reduces public perceived water risks, while distrust easily leads to public skepticism and questions about water safety.

The following sections summarize the literature on the roles of trust and risk perception, and their relationship in household water use. First, the defining characteristics of trust and risk perception are conceptualized and distinguished, followed by their conceptual development and academic measurement in water-related studies. Then, the influences and interactions among trust, risk perception, and household water use are introduced. The next section examines the external, internal, and informational factors that contribute to the construction of trust and risk perception. Finally, a few underexplored topics for future studies are suggested.

Conceptualizing Risk Perception and Trust

Risk Perception

Risk indicates a specific intermediate state between safety and destruction, by which people feel threatened or feel a potential harm or expected loss and thus take actions accordingly (Weinstein, 1999). In this sense, risk perception refers to the judgments or perceived possibility of loss when people are under threat or faced with hazardous activities and technologies (Rousseau et al., 1998; Stone & Winter, 1987). Risk perception is socially constructed (Slovic, 1987) and there is often a gap between how scientists and the public understand risks. The public tends to have a broad conception of risk, embracing attributes such as uncertainty, controllability, and equity into their risk equation, whereas scientists define risk in relation to event probabilities. Subjective factors that matter in perceptions of the public are treated as “accidental” dimensions of risk (Po et al., 2003). Instead of being a result of objective assessment based on experiences, beliefs, attitudes, and broader social, cultural, and institutional processes (Pidgeon, 1998), perceived risks often depend on peoples’ intuitive judgments associated with feelings of uncertainty, discomfort, anxiety, conflict, concern, pain, and cognitive dissonance (Khattab et al., 2015). With all these feelings, people tend to associate risks with negative benefits and returns even though they are usually positively correlated in the real world (Fischhoff et al., 1978).

The composition and determinants of risk perception are extremely complex. People develop different categories of risk perception (i.e., individual risk perception, family risk perception, and group risk perception) toward diverse subjects, including events, activities, infrastructures, and technologies (e.g., nuclear power, natural hazards, and genetically modified food) (Slovic, 1987). Based on the content, risk perception includes systemic risks, health risks, environmental risks, and so forth (Alexander et al., 2008).

Weber (2001) identified three approaches in risk-perception research. The first is principal measurement, which focuses on how people subjectively absorb objective information. The second approaches risk socioculturally, with which different risk perceptions of various groups with different cultural backgrounds and social classes are distinguished. The last approaches risk psychologically and detects people's emotions in risky situations. Furthermore, risk perceptions can be measured both at the macrolevel and the microlevel. The former examines the public's perception on general social risks and the latter assesses the participation, uncertainty, and satisfaction of the group involved in a specific event or a certain type of risk (Wang, 2017).

Trust

Trust is a multifaceted concept that varies with different perspectives. From a psychological perspective, trust normally refers to "a state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (Rousseau et al., 1998, p. 395). From an economic perspective, trust is a rational aspect of human behavior that is built when people pursue long-term interests in a repeated game model (Zhang & Ke, 2002). As one of the fundamental principles upon which human society is built, social scientists often discuss trust in socially embedded properties of relationships among people or organizations (Rousseau et al., 1998). From this socio-behavioral perspective, the definition of trust involves four main characteristics (Coleman, 1994). First, trust involves at least two parties, among whom one party, that is, the trustor, can choose whether to voluntarily place trust on the other party, that is, the trustee, including but not limited to people, organizations, and institutions. The trust here placed on the trustee could be in various forms including, but not limited to, money, time, effort, support, affection, and so forth. Second, after trust is placed, the trustee can choose to honor or abuse the trust. Either way, the trustor has no control over the actions of the trustee. Third, there is a time lag during which the trustor has delivered their trust and yet is not aware of the behavior of the trustee. Last, the trustor is better off to place trust than not to do so if the trustee is trustworthy; however, the trustor is worse off should the trustee be untrustworthy, assuming both parties are utility maximizers. When a trustor chooses to trust a trustee, it shows that the trustor is willing to be at risk to the trustee based on their belief that the trustee will perform beneficially (Zhen et al., 2019). According to Fukuyama, trust is "the expectation that arises within a community of regular, honest and cooperative behavior, based on commonly shared norms, on the part of other members of that community" (Fukuyama, 1995, p. 26). In diverse studies of different subjects, trust is taken as a predictor that affects decisions in various contexts. It is believed to be effective on occasions when deficiencies in knowledge, experience, or familiarity arises with certain products, processes, or entities. It is generally regarded as a form of social capital that determines economic growth and social progress in addition to forms of material capital and human capital (Zhang & Ke, 2002). Lack of trust could affect the acceptance of new technologies, provoke political protests, and hamper otherwise beneficial adjustments.

Trust is usually conceptualized as having many dimensions, and the classification of trust is diversified. Several researchers have sought to categorize trust based on its source, such as through processes, characteristics, competence, and institutions (Edelenbos & Eshuis, 2012; Lindgreen, 2003; Zucker, 1986). For instance, in the field of risk management, Earle (2010) summarized two types of trust from social-relational and ability aspects, which he labels "relational trust" and "calculative trust," respectively. The former is derived over time based on interactions between the trustor and trustee. The latter is a rational evaluation that others are not likely to cause harm to one's own interests, which is usually formed from "past behavior of the other and/or on constraints on future behavior" (Earle, 2010, p. 542). However, identifying the source of trust is not an easy task. Some scholars thus divide trust based on the type of trustee or object of trust, distinguishing between individual or interpersonal trust, organizational trust and institutional trust (Chen, 2008; de Jonge et al., 2008; Freyer et al., 2014). Individual trust is placed on other individuals and originated from interpersonal relationships built on face-to-face interactions and contacts (Jorgensen et al., 2009). Organizational trust is the trust put on an organization such as a company or a civil society group. This type of trust usually arises from the trustor's belief in the integrity, capability, and beneficence of the organization. Institutional trust is placed in institutional arrangements or official rules, such as policies, regulations, and contracts (Bovens & Wille, 2011; Hobbs & Goddard, 2015; Li, 2004). This type of trust indicates that the trustor has confidence in the capability and reliability of institutional actors, including governments, authorities, and regulatory agencies in implementing regulations efficiently, impartially, and consistently (Wang et al., 2015). In order to observe and identify trust in a more manageable way within complex settings, dividing trust according to the trustee's type is a more popular practice.

Risk Perception and Trust in Water-Related Studies

The notions of risk perception and trust have been widely applied in water-related fields. Risk perception in household water use mainly concerns health and the environment. It touches on not only whether household water provision is sufficient for use and safe for drinking (Spence & Walters, 2012), specified as people's subjective assessment about the quantity and quality of household water supply (Anadu & Harding, 2000), but also on the impacts of water user behavior imposed on the environment (Rathnayaka et al., 2014). Water-related trust normally refers to the trust in agencies involved in water supply, water treatment, water recycling, and so forth. This entry specifically pays attention to trust in individuals and institutions involved in these water use processes. A typical instance is people's trust in the quality of drinking water supplied by water corporations. A notable difference is that, compared to risk perception, trust often emphasizes the social and political dimensions rather than the biophysical dimension of water. In addition to household water users, various actors such as water suppliers, water-related government authorities, scientific experts, media journalists, and neighbors are also involved in the analysis of trust and risk perceptions in household

water use. These actors are not only trustees that household water users choose whether to place their confidence in but are also knowledge and information manufacturers who influence household water users' risk perception on water quality and quantity.

Studies involving risk perception, trust, and household water use can be traced back in the 1990s, when scholars were attracted to the connection between odor and people's perception on water quality (Jardine et al., 1999; McGuire, 1995). But most literature appeared after the 2000s, particularly after 2009, which demonstrates a scholarly trend toward more in-depth psychological examination of water use since then. In terms of the cases chosen in the existing studies, most of them appear in the United States, Australia, the European Union, and Canada. For developing countries, there still lacks investigation, though in recent years several articles have paid attention to Pakistan (Khalid et al., 2018), Nigeria (Abubakar, 2019), and Mexico (Rodríguez-Tapia et al., 2017). The scales of the cases range from the community, city, to state and country. Most of the studies choose to carry out their analysis based on evidence collected in one city or state. Only a few qualitative method-based studies have taken a community as the unit of analysis. For instance, Anthonj et al.'s (2019) research on the relations between health risk perceptions and water-related disease exposure have taken one Kenyan wetland community as an example and found that risk perceptions do reflect the actual risks of water and shortcomings of its management.

Key topics of these studies include how to measure risk perception and trust more precisely, how risk perception and trust affect household water choices and conservation behavior, how the two factors interact with each other, and what influences people's risk perception of and trust in water. Under these topics, most studies focus on drinking water, while other purposes, such as toilet flushing and watering gardens, are relatively underexplored. From a chronicle perspective, risk perception and trust in water-related studies have experienced a shift from general studies in communities to more detailed deliberation on the differentiation between groups in specific contexts, such as children (Gorelick et al., 2011), parents (Merkel et al., 2012), and impecunious and vulnerable groups (Schmidt & Cairncross, 2009; Spence & Walters, 2012). In the following sections, the article will present how these topics have been investigated and debated.

Relations Between Risk Perception, Trust, and Household Water Use

The Measurement of Risk Perception and Trust in Household Water Use

The measurement of trust and risk perception in household water use is a popular topic. Questionnaire surveys, interviews, discussion panels, and workshops are common approaches to investigating both risk perception and trust in household water use. Some criteria, including concept construction, prediction performance, reliability and validity, practical implications, and usability can be followed to choose the suitable methods or models for measurement (Vincent-Wayne, 1999). Although quantitative metrics and models using survey

data are the most popular tools to measure the two psychological elements, qualitative evaluations and comparisons gathered from media, interviews, and other descriptive materials are gradually getting attention.

For risk measurement, a classic two-component multiplicative model has been adopted for several decades, in which risk equals the multiplication of probability and importance of negative consequences (Peter & Ryan, 1976; Vincent-Wayne, 1999). Stemming from this classic model, Dowling and Staelin (1994) proposed a model to calculate overall perceived risk of consumers as the sum of category risk plus specific risk. The category risk involves individual-level variables and attributes of the product category. The specific risk involves consuming goals, consuming situations, and specific product attributes. Although the result of this calculation is referred to as the perceived risk, it is notable that the model and its components are not as subjective as the definition of risk perception. If perceived risks can be elicited in the form of probabilities, then there is no question to use statistical models to evaluate the degree to which subjectively assessed risk corresponds to the objective risk. However, perceived risks usually differ from objectively measured risks or science-based estimates risks. For instance, in controllable situations (e.g., car accidents), people tend to have less perceived risks than objective risks. For grave dangers that people have little control (e.g., water poisoning), people tend to have much higher levels of perceived risks than estimated real risks (Jakus et al., 2009). Therefore, people's subjective feelings about risks need further investigations in addition to statistical methods.

Another frequently used method to measure both perceived risks and trust in household water use is psychometric technique, which inspects trust and perceived risks from target groups directly (Fischhoff et al., 1978; Slovic, 1987). Questionnaires are a common psychometric tool to assess trust and perception. Some scholars use household or individual data collected in extant national investigations. For instance, Spence and Walters (2012) used the 2001 Aboriginal Peoples Survey of Canada to acquire venerable group's risk perception of drinking water. For other researchers, they may collect firsthand survey data through scaled statements to manifest perceived risk variables (Grafton et al., 2011). The respondents are usually asked to rate each on a Likert-type scale or bipolar scale according to each question or statement (Jakus et al., 2009), such as "there are health risks associated with drinking tap water in my home" (Doria de Franca et al., 2009), and to what extent they have confidence in the authorities or government agencies (Fairbrother et al., 2019). The measurement of trust can be reflected by a single statement such as "this information is trustworthy" (Eiser et al., 2002) or by different aspects of trust such as "the politicians in the municipality have enough knowledge about the water distribution issue to make good decisions on the subject" and "I felt that the authorities had the situation under control and knew what they were doing" (Bratanova et al., 2013). In some studies, risks perceptions of different components of water are separately assessed instead of acquiring only one variable of general risk perception. For instance, Anthonj et al. (2019) embraced 22 risk factors such as poor water quality, mosquito habitats, and environmental pollution to evaluate health risk perceptions in wetlands. Each factor was assessed with specific statements in the survey.

A major challenge to the psychometric approach is that the statements or questions used in the questionnaire survey are not always flexible enough to obtain more details and rationale beyond the metrics. The longitudinal media content is a popular qualitative approach for addressing this challenge and providing detailed analysis of trust and risk perception. For instance, Driedger et al. (2013) selected media presentations that reflect water supply issues in the communities of a specific city to form a material set from which the public's reaction toward water-related topics or events can be extracted. Trust can be captured in the form of expressing faith or belief in the information provided and from general feelings about the integrity and capacity of trustees such as individuals, organizations, and authorities. However, a major weakness of using media presentations is that they could be a narrow lens in understanding how the content constructs public discourses about a water-related topic.

To supplement metrics and content analysis, open-ended and semi-structured interviews are conducted to provide more nuanced understanding of individual perceptions of and experiences with water use (Anthonj et al., 2019). Additionally, another approach is focus group discussions, which are usually made up of an introduction of the purpose, a plenary discussion in which participants are encouraged to write down any ideas they would like to express, small group discussions, and a summarizing plenary session (Alexander et al., 2008). These conversations allow for further in-depth discussions about why people express the ideas they feel. Of all the measurement methods, one major limitation lies in the static attribute of the survey, which means it captures trust or risk perceptions only at one time point and thus cannot entirely elucidate the dynamic perceptions in different seasons and years. A longitudinal survey design and time series investigation may address this issue, particularly for a certain event.

The Effects of Risk Perception and Trust on Household Water Use

In many contexts, a high level of risk perception and distrust can be costly. People may take excessive safeguards or prevention measures, which may be unnecessary, to avoid perceived potential losses. Also, people tend to miss opportunities that involve some vulnerabilities but will be eventually beneficial to them. In this sense, risk perception and trust can pose multidimensional impacts on household water use, including both choices of alternative water sources and conservation behavior.

First, the choice of alternative water sources, such as tap water, bottled water, recycled water, and desalinated water, is a clear manifestation of the impacts of risk perception and trust on household water use. Health risk perception of tap water (i.e., people feel that tap water without treatment can cause health problems), for instance, would influence such choices. Jakus et al. (2009) revealed that bottled water consumption increases with the rise of perceived health risks of tap water. This conclusion confirmed a generally recognized belief that bottled water is safer than tap water and thus could serve as a substitute for tap water. As a result, higher health risk perceptions about tap water can lead to more bottled water purchases (Gorelick et al., 2011). Additionally, water treatment measures such as boiling tap water can also be seen as substitutes for tap water. In this sense, risk perception significantly

correlates with the decisions of households to treat piped or non-piped water before drinking it (Onjala et al., 2014). For example, adopting a “Risk – Attitude – Norm – Ability – Self-regulation” (RANAS) model proposed by Mosler (2012), Daniel et al. (2019) proved that as one of the five psychological factors, perceived risk—including perceived vulnerability, health, severity on life, and severity on a child under 5 years—influences the practice and adoption of technology in household water treatment. However, it is not always the case that perceptions of health risks from tap water can be translated into spending on bottled water. Environmental risk perceptions, for instance, may supersede implications of health risk perceptions, which indicates people’s concerns about the possibility of environmental pollution caused by behavior such as drinking bottled water. Li et al. (2019) found that in Singapore bottled water is associated with higher costs and environmental risks, which lowers the probability of bottled water consumption and maintains a high probability of drinking tap water.

Like risk perceptions, trust was shown to be involved in people’s decisions to accept or reject the use of unconventional water sources (Po et al., 2005). Trust influences alternative water source choices in various ways due to skepticism or uncertainty about safety or regulations of water quality and water supply. Peoples’ trust in science and government are positive psychological predictors of comfort with alternative water sources (Fielding et al., 2015). Institutional trust in authorities responsible for municipal water supply can shape and mediate public opinion of reused water (Ormerod & Scott, 2013). The high degree of institutional trust placed in water supply authorities, which is usually based on the experience of good quality water provision, could result in a preference for fresh tap water over bottled water. In contrast, distrust of water providers and government services is associated with more bottled water consumption (Fragkou & McEvoy, 2016).

Second, conservation patterns in household water consumption, such as installing water-saving technologies, are also shaped by risk perception and trust. Drawing on the New Environment Paradigm-Human Exception Paradigm (NEPHEP), Corral-Verdugo et al. (2003) examined the relationship between environmental beliefs and water-saving behavior, showing that environmental beliefs significantly influence specific water consumption behavior. Perceived environmental risks, such as concerns on waste generation, water pollution, and natural resource depletion, are proven to have a statistically significant effect on household water conservation behavior (Grafton et al., 2011). For instance, households with high environmental concerns tend to turn off the water while brushing teeth ($r = 0.045$), take a shower instead of a bath ($r = 0.01$), and water the garden in a water-saving way ($r = 0.023$). Likewise, supporters of environmental organizations are more likely to adopt water conservation behavior such as turning off water while brushing teeth ($r = 0.056$) and plugging the sink when washing dishes ($r = 0.11$) (Grafton et al., 2011; Willis et al., 2011).

Organizational trust and institutional trust also matter in household water conservation performance in the sense that they influence the level of accountability of water providers or agencies (Jorgensen et al., 2009). Trust influences household participation in community resource management (Bouma et al., 2008). Household water consumers tend to engage in more water conservation activities when they trust the evaluation of water providers or

related agencies' claim that there is a need to conserve (Lee, 1981; Lee & Warren, 1981). Individual or interpersonal trust also shapes household water conservation, as people tend to save water when they feel water is scarce and others are minimizing their consumption in water use (Jorgensen et al., 2009). In contrast, people will legitimize their failure of conservation, which leads to a high level of water consumption, if they do not trust others to save water (Corral-Verdugo et al., 2002; Jorgensen et al., 2009).

Overall, the influences of risk perception and trust on household water use vary across cases and contexts, but a general pattern of regularity is shown in Figure 1. It is shown that interpersonal and institutional trust can generally lead to the choice of tap water and recycled water and contribute to water conservation, while different types of risk perception may affect household water use in opposite directions. People's health concerns, which are caused by their perception of poor water quality, may lead to less use of recycled water and tap water. Those who worry about potential environmental degradation caused by unfriendly water use behavior tend to save water, increase water reuse, and choose tap water over bottled water.

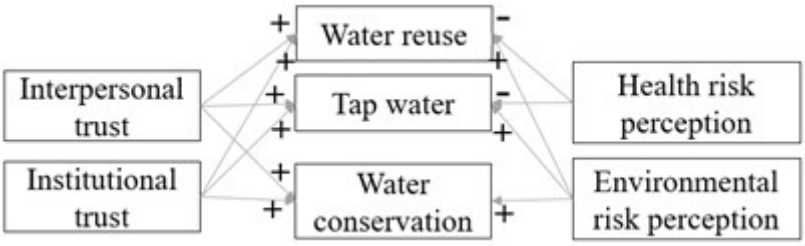

Figure 1. The influence of risk perception and trust on household water use.

Interactions Between Risk Perception, Trust, and Household Water Use

Risk perception and trust are intimately related (Bratanova et al., 2013). Abundance of empirical studies have tested interactions between trust and risk perception in a series of fields such as natural hazards (Lindell &Hwang, 2008), energy supply (Volland, 2017), food (Eiser et al., 2002; Poortinga & Pidgeon, 2005), and water use (Ross et al., 2014). In many cases, causal relationships between the two are detected. For instance, Lobb et al. (2007) showed that trust in public authorities reduces risk perceptions in purchasing chicken. Similarly, Eiser et al. (2002) adopted the two models of trust, causal model and associationist model, and found that the interaction between trust and acceptance of food technologies is mediated by perceived risk. In the field of risk management, Pavlou (2014) found that people's perception of risk decreases when they have more trust, as it reduces uncertainty and enables people to accept risks that can be managed by responsible institutes.

Various methods, including the multivariate regression analysis, structural equation model (SEM), associationist model, causal chain model (Bratanova et al., 2013), and Bayesian belief network model (Daniel et al., 2019) have been applied to examine complex interrelations between trust, risk perception, and household water use. Another widely used approach in water-related investigations is the theory of planned behavior (TPB) framework proposed by

Ajzen (1985). The TPB framework defines human action as a combination of three dimensions, namely, behavioral beliefs, normative beliefs, and control beliefs, which jointly generate the intention to behave or choose (Ajzen, 1991). Lobb et al. (2007) improved the TPB to a SPARTA (subjective norm – perceived behavioral control – attitudes – risk perception – trust – alia) model in which the components and other variables interact with each other and together lead to the intention to take actions.

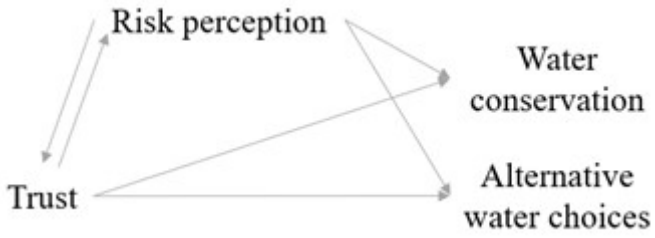

Figure 2. Interactions between risk perception, trust, and household water use.

The interrelationship between trust and risk perception and their effects on household water use demonstrate the direct impact of trust on water use behavior as well as the indirect impact of trust mediated by risk perception (see Figure 2). This can be understood from two perspectives. On the one hand, trust is a significant social capital, which shapes risk perception that directly influences household water use choices. Political trust can significantly reduce the risk perception of tap water with the results varying among general trust ($\chi^2 = 82.420$), fairness trust ($\chi^2 = 67.939$), honesty trust ($\chi^2 = 53.684$), and capability trust ($\chi^2 = 44.476$) (Zhen et al., 2019). Trust in the information provided by various sources, particularly experts and authorities, has been shown to reduce risk perceptions of household recycled water use while improving its acceptability; specifically, those who trust in federal regulators ($\chi^2 = 28.43$), state regulators ($\chi^2 = 31.08$), and water utilities ($\chi^2 = 36.6$) are more likely to accept reclaimed water (Ormerod & Scott, 2013). On the other hand, risk perception is a mediator in the effect of trust on household water use. Ross et al. (2014) found that, when facing severe drought, trust positively influences the acceptance of recycled water ($r = 0.33$) and this effect is mediated by risk perceptions with a standardized indirect effect of 0.430 ($r = -0.67$, $r = -0.64$). Likewise, prior trust has positive effects on reducing risk perception of waterborne disease outbreak and thus influences the acceptance of certain water use behavior or technology (Bratanova et al., 2013). Similarly, trust can also be a mediator for risk when determining households' water use behavior. For instance, people's health risk perception, which is raised by a recycled water poisoning event, could affect their trust in the government or water-related institutions, thus reducing their willingness to adopt reused water (Driedger et al., 2013).

Factors That Determine Risk Perception and Trust in Household Water Use

With the focus of general studies of risk perception and trust shift toward the differentiations of various social groups in specific contexts, many scholars are intrigued by the factors that determine people's trust and perceived risks in household water use. From a rational choice perspective, three groups of factors determine actors' behavior: (a) payoff functions, which are usually determined by externally imposed institution and policies; (b) individual preferences; and (c) information about other actors' behavior and preferences (Osborne, 2004; Raub et al., 2011; Zhang & Ke, 2002). Similarly, determinants of trust and risk perception in household water use can be generally attributed to external factors, internal factors, and information factors (Table 1). Both water-related risk perceptions and trust are contextually based and closely associated with personal characteristics and information reception.

Table 1. Factors Influencing Risk Perception and Trust

Categories	Examples
External factors	Characteristics of water-related authorities, e.g., normative coherence, transparency, familiarity, accountability, etc.
Internal factors	Demographic attributes and household/individual characteristics of water users, e.g., age, gender, education level, etc.
Information factors	Odor and color of water, the behavior of friends or neighbors, media news, etc.

External Factors

External factors are the structural and institutional elements that shape trust and risk perception. These factors are associated with the need for transparency, accountability, responsibility, and independence of the institutional system (Alexander et al., 2008). Sztompka (1999) proposed a model of the formation process of trust, or the social becoming of trust, in which five structural factors that provide opportunities to build trust are identified: normative coherence, stability of social order, transparency, familiarity, and accountability. Similarly, Ross et al. (2014) modelled three trust predictors—fairness, identity, and credibility—when studying potable recycled water schemes. As a product of the formation of trust for dealing with future situations that are unclear and uncontrollable, risk perception is also affected by these external factors.

Normative coherence indicates the awareness triggered by a coherent legislation and regulation system. When authorities and the regulations are perceived as devoted to the welfare of the public, trust level tends to be higher. Likewise, government officials are considered reliable when they demonstrate deep concerns for the public (Wray et al., 2006).

Transparency represents the extent of information disclosure of social institutes. The trust in the political system and politicians is, to a certain degree, evidence based. Political distrust is more widespread in countries with insufficient information and widespread corruption (Fairbrother et al., 2019). Marks and Zadoroznyj (2005) also found that institutional arrangements that provide transparent governance are needed to facilitate trust in water reuse, as it impacts trust in water providers or water agencies.

Familiarity shows whether the public has knowledge of the activity in a changing context. The involvement of the public in water issues is important to raise their trust in the government as the involvement increases their understanding of related facts and knowledge. Radcliffe (2006) argued that raising public awareness and participation in decision-making was important for gaining public trust in water recycling. Some cities in Marks and Zadoroznyj's (2005) investigation employed public relations personnel to communicate with community members with the objective to increase their trust in recycled water.

Accountability indicates how the institutions provide checks and balances for insurance. This coincides with the concept of credibility, one of the three trust predictors that Ross et al. (2014) modelled when studying potable recycled water schemes. They found that fair procedures impact the formation of identity among community members, and this shared social identity in turn promotes members' trust in authorities. Marks and Zadoroznyj (2005) also point out the importance of accountable governance in shaping the positive social atmosphere that is associated with the trust in water providers.

Internal Factors

In addition to structural and institutional elements, the cognitive-emotive processes of individuals also greatly influence the risk perception and trust of water (Doria de Franca, 2009; Pidgeon et al., 1992). Thus, internal factors such as demographic attributes and household/individual characteristics have received much academic attention (Newton et al., 2018, p. 39).

Trust is related to people's characteristics, personality, and predispositions. Gender, age, educational and cultural background, ethnicity, economic status, and homeownership status are frequently identified as determinants that shape perceived risks as they may influence people's cognitive-emotive process and their values and willingness to take water-related actions (Pierce & Gonzalez, 2017; Spence & Walters, 2012). For instance, it has been shown that women's risk perception toward drinking water is higher than that of men (Anadu & Harding, 2000); college graduates have the highest percentage of recycled water supporters (Garcia-Cuerva et al., 2016); youth aged between 18 and 24 are more likely to believe that people become sick from drinking tap water and that bottled water is safer than tap water

(Dupont et al., 2014). Although Garcia-Cuerva et al. (2016) have indicated that risk perceptions for water shortages and water conservation rise with age, other studies contend that the influence of age on risk perception of water is not linear because the influence can be both positive and negative as the object of risk varies (Skuras & Tyllianakis, 2018). A brief summary the magnitude of these effects is shown in Table 2.

Table 2. The Effects Internal Factors on Risk Perception of Drinking Water (Odds Ratio)

Articles	Gender	Age	Education	Health	Race	Social and Living Environment
Spence and Walters (2012)	Male (0.876)	—	Low (0.786)	Poor (1.284)	—	Living in the Arctic (1.941) Living in different provinces (many of them are significant)
Pierce and Gonzalez (2017)	—	—	High school (1.15)	—	Black (0.7)	Housing unit rating (0.83) Building built in 1990 or later (0.96) Trailer park (0.64) Small system (1.3) Neighborhood rating (1.14) Ownership of housing unit (1.36)
Dupont et al. (2014)	Female (1.26 —higher bottled water expenditures)	18–24 (4.11 bottled water is safer than tap, 2.83—higher bottled water expenditures, 0.68%–100% bottled water drinker)	—	—	—	—
Skuras and Tyllianakis (2018)	Male (0.744—Chemical pollution risk, 0.895—Changes to ecosystems)	Can be both positive and negative on different risks	Completed education (all > 1.1—Algae growth,	—	—	Living in rural areas (0.922—Chemical pollution, 0.844—Chemical pollution) Living in large towns (1.122—Chemical pollution)

Articles	Gender	Age	Education	Health	Race	Social and Living Environment
			chemical pollution risk, changes to ecosystems)			

Risk perceptions and trust are not only informed by individual psychological factors but are also shaped by interdependent social, cultural, and historic contexts. In examining public perceptions of indirect potable reuse in Tucson, a desert city, Ormerod and Scott (2013) found that trust is a central factor and social groups differ in their perceptions of risks due to their divergence in experiences, identities, and moral values. Similarly, ingrained cognitive paradigms and cultural expectations also constrain the range of households' acceptable water use options (Stenekes et al., 2006). Some risks are recognized while others are repressed. This is correct intuitively as people tend to rely on their social and moral values to assess situations and to avoid using water that they consider risky (Po et al., 2003).

In addition to personal attributes, neighborhood and broader built environment characteristics are also important because the quality of a housing unit and public water services provided to a neighborhood may affect perceived water risk (Pierce & Jimenez, 2015). For instance, standalone mobile home units rely more on small water systems than other housing units do. One is less likely to perceive the risk of pollution or other threats related to water if they live in a rural environment (Skuras & Tyllianakis, 2018).

Information Factors

A person is expected to form an understanding of relative threat when provided with information (Mosler, 2012). In this sense, information about water itself, the behavior of friends or neighbors, news in the media, and public engagement of government authorities and water companies could all affect trust and risk perception in water use. Generally, the more information about water-related issues a household can obtain, it's less likely they perceive their water consumption is risky (Skuras & Tyllianakis, 2018).

The physical characteristics of water, such as taste and odors, are direct information that forms people's risk perception on drinking it. Doria de Franca et al. (2005) use a structural equation model (AGLS estimator) to show that people tend to link offensive taste and odors of physical tap water to potential health risks, given that is the basic information they have to directly judge quality. However, the influence of physical information on risk perception can be weaker than that of external information from friends and the media, although the former is more direct (Doria de Franca et al., 2005). Additionally, experience with alternative water sources or water authorities could affect trust and risk perception of household water consumers. One is more likely to accept alternative water sources if they currently experience poor quality of water supply (Sims & Baumann, 1974). Besides, those who have had negative interactions with the government may deem them unreliable and choose to trust nongovernment sources of information or services instead (Wray et al., 2006).

Indirect information from relatives, friends, or neighbors regarding the quality of tap water or recycled water can influence one's own risk perception and trust according to the network theory of contagion (Scherer & Cho, 2003). Individual perceptions are the results of the attitudes or behavior of networks and self-organizing systems in which they communicate with each other. Those who are more engaged with others in interpersonal networks have more

opportunities to exchange information, and thus they are more likely to share similar perceptions, beliefs, and behavior on same topics (Fessenden-Raden et al., 1987; Scherer & Cho, 2003).

Not only could social network amplify the impacts of information on trust and risk perception, more importantly, mass media and social media also play a key role in providing information to the public that influences the formation or evolution of trust and risk perception (Doria de Franca, 2009; Wray et al., 2006). The media has become the primary information source in which hazards and threats occurring around the world are thoroughly documented. Therefore, how the media describes household drinking water can have a significant influence on public perception of water and on the trustfulness in relatives and authorities. Appropriate media coverage can clarify the facts and mediate risk perceptions, whereas misleading media coverage may cause unnecessary anxiety and skepticism. For instance, on the rare circumstances when chlorination is reported in the media, it is portrayed negatively and is easily considered connected to its byproducts risks (Doria de Franca, 2009; Driedger & Eyles, 2003). Furthermore, as pointed out by Coleman (1993), dependence on only one media platform such as television may to some extent restrict the overall risk condition that people can obtain because television information is less in-depth than written reports. Therefore, the diversity of news resources is also a determinant of people’s risk perception.

Lastly, people can build perceptions and decisions by social conformity without specific information on water use. Water use behavior is embedded in, as well as shaped by, social, cultural, and historic contexts. People sometimes make water use decisions simply because others in their community have done so (Leong & Lebel, 2020). Public narratives and discourses around water choices or water conservation also shape water consumers’ behavior, which is subject to the influence of a broader social and political framework that constructs knowledge about water with or without direct water use information. For instance, household water users tend to trust new water regimes if the narrative constructed by the interpretive community provides sufficient legitimacy for the change (Leong, 2015).

Future Directions

In summarizing the advances in studies of risk perception and trust in household water use, four directions are worth further exploration.

First, new dynamics of risk perception and trust and their effects on household water use are worth investigation in the era of information explosion. The rapid development of information technology and the growing influence of social media have substantially reshaped the way information is generated and received. As the mechanisms of information generation, exchange, dissemination, and iteration are rapidly changing, new features of risk perception and trust have emerged that are altering people’s behavior. Exploring how shifting technical contexts reshape risk perception and trust can help decision-makers and scholars understand new driving forces for household water use behavioral changes and inform future water policy instruments.

Second, the coevolution mechanism of risk perception and trust in household water use also warrants further exploration. While many scholars have pointed to trust as a mediator of risk perception, how risk perception can mediate trust in household water use is understudied. In practice, risk perception and trust, as two interconnected psychological elements, rarely perform in isolation. Their coevolution, in different temporal and spatial settings, may demonstrate a variety of characteristics that affect households' water use behavior in ways that remain to be fully understood.

Third, in what ways, as well as to what extent, the effects of risk perception and trust on water use behavior vary across geographical contexts remain uncertain. On the one hand, with most studies choose city-level or state-level data, there is a question mark hanging over whether the existing findings also apply to other places with completely different socioeconomic and political conditions. On the other hand, it is unclear whether and how residents' water use behavior in one jurisdiction can be influenced by the spillover effects from another jurisdiction. Even in a few studies using national survey, no cross-region relations have been detected.

Last but not least, the nuanced effects of different types of risks on household water use remain to be explored. For instance, few studies have examined the differences between controllable risks such as pollution and uncontrollable risks such as natural disasters. More in-depth analysis of different types of risks and their impacts would not only generate more comprehensive understanding of how risk perception shapes household water use but also inform policy instruments that manage risk perception and facilitate water conservation behavior.

Further Reading

Aprile, M. C., & Fiorillo, D. (2017). Water conservation behavior and environmental concerns: Evidence from a representative sample of Italian individuals. *Journal of Cleaner Production*, *159*, 119–129.

Brown, J., Hamoudi, A., Jeuland, M., & Turrini, G. (2017). Seeing, believing, and behaving: Heterogeneous effects of an information intervention on household water treatment. *Journal of Environmental Economics and Management*, *86*, 141–159.

Garcia, X., & Pargament, D. (2015). Reusing wastewater to cope with water scarcity: Economic, social and environmental considerations for decision-making. *Resources, Conservation and Recycling*, *101*, 154–166.

Grupper, M. A., Schreiber, M. E., & Sorice, M. G. (2021). How perceptions of trust, risk, tap water quality, and salience characterize drinking water choices. *Hydrology*, *8*(1), 49.

Gu, Q., Chen, Y., Pody, R., Cheng, R., Zheng, X., & Zhang, Z. (2015). Public perception and acceptability toward reclaimed water in Tianjin. *Resources, Conservation and Recycling*, *104*, 291–299.

Khan, N. I., Brouwer, R., & Yang, H. (2014). Household's willingness to pay for arsenic safe drinking water in Bangladesh. *Journal of Environmental Management*, *143*, 151–161.

Koehler, J., Rayner, S., Katuva, J., Thomson, P., & Hope, R. (2018). A cultural theory of drinking water risks, values and institutional change. *Global Environmental Change*, *50*, 268–277.

Mankad, A., & Tucker, D. (2012). Alternative household water systems: Perceptions of knowledge and trust among residents of South East Queensland. *Ecopsychology*, *4*(4), 296–306.

West, C., Kenway, S., Hassall, M., & Yuan, Z. (2016). Why do residential recycled water schemes fail? A comprehensive review of risk factors and impact on objectives. *Water Research*, *102*, 271–281.

Wester, J., Timpano, K. R., Çek, D., Lieberman, D., Fieldstone, S. C., & Broad, K. (2015). Psychological and social factors associated with wastewater reuse emotional discomfort. *Journal of Environmental Psychology*, *42*, 16–23.

Zhen, N., Barnett, J., & Webber, M. (2020). Is trust always a precondition for effective water resource management? *Water Resources Management*, *34*, 1423–1436.

References

Abubakar, I. R. (2019). Factors influencing household access to drinking water in Nigeria. *Utilities Policy*, *58*, 40–51.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action control: From cognition to behavior* (pp. 11–39). Springer.

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, *50*(2), 179–211.

Alexander, K. S., Price, J. C., Browne, A. L., Leviston, Z., Bishop, B. J., & Nancarrow, B. (2008). *Community perceptions of risk, trust and fairness in relation to the indirect potable use of purified recycled water in South East Queensland: A scoping report*. Urban Water Security Research Alliance Technical Report.

Anadu, E. C., & Harding, A. K. (2000). Risk perception and bottled water use. *Journal American Water Works Association*, *92*(11), 82–92.

Anthonj, C., Diekkrüger, B., Borgemeister, C., & Thomas, K. (2019). Health risk perceptions and local knowledge of water-related infectious disease exposure among Kenyan wetland communities. *International Journal of Hygiene and Environmental Health*, *222*(1), 34–48.

Bennear, L. S., Lee, J. M., & Taylor, L. O. (2013). Municipal rebate programs for environmental retrofits: An evaluation of additionality and cost-effectiveness. *Journal of Policy Analysis and Management*, *32*(2), 350–372.

Bouma, J., Bulte, E., & van Soest, D. (2008). Trust and cooperation: Social capital and community resource management. *Journal of Environmental Economics and Management*, *56*(2), 155–166.

Bovens, M., & Wille, A. (2011). Falling or fluctuating trust levels? The case of the Netherlands. In S. Zmerli & M. Hooghe (Eds.), *Political trust: Why context matters* (pp. 47–66). ECPR Press.

Bratanova, B., Morrison, G., Fife-Schaw, C., Chenoweth, J., & Mangold, M. (2013). Restoring drinking water acceptance following a waterborne disease outbreak: The role of trust, risk perception, and communication. *Journal of Applied Social Psychology*, *43*(9), 1761–1770.

Brooks, D. B. (2006). An operational definition of water demand management. *International Journal of Water Resources Development*, *22*(4), 521–528.

Chen, M. F. (2008). Consumer trust in food safety—A multidisciplinary approach and empirical evidence from Taiwan. *Risk Analysis*, *28*(6), 1553–1569.

Coleman, C. L. (1993). The influence of mass media and interpersonal communication on societal and personal risk judgments. *Communication Research*, *20*(4), 611–628.

Coleman, J. S. (1994). *Foundations of social theory*. Harvard University Press.

Corral-Verdugo, V., Bechtel, R. B., & Fraijo-Sing, B. (2003). Environmental beliefs and water conservation: An empirical study. *Journal of Environmental Psychology*, *23*(3), 247–257.

Corral-Verdugo, V., Frias-Armenta, M., Pérez-Urias, F., Orduña-Cabrera, V., & Espinoza-Gallego, N. (2002). Residential water consumption, motivation for conserving water and the continuing tragedy of the commons. *Environmental Management*, *30*(4), 527–535.

Daniel, D., Diener, A., Pande, S., Jansen, S., Marks, S., Meierhofer, R., & Rietveld, L. (2019). Understanding the effect of socio-economic characteristics and psychosocial factors on household water treatment practices in rural Nepal using Bayesian belief networks. *International Journal of Hygiene and Environmental Health*, *222*(5), 847–855.

De Jonge, J., Van Trijp, J., van der Lans, I. A., Renes, R. J., & Frewer, L. J. (2008). How trust in institutions and organizations builds general consumer confidence in the safety of food: A decomposition of effects. *Appetite*, *51*(2), 311–317.

Doria de Franca, M. (2006). Bottled water versus tap water: Understanding consumers' preferences. *Journal of Water and Health*, *4*(2), 271–276.

Doria de Franca, M. (2009). Factors influencing public perception of drinking water quality. *Water Policy*, *12*(1), 1–19.

Doria de Franca, M., Pidgeon, N., & Hunter, P. (2005). Perception of tap water risks and quality: A structural equation model approach. *Water Science and Technology*, *52*(8), 143–149.

Doria de Franca, M., Pidgeon, N., & Hunter, P. R. (2009). Perceptions of drinking water quality and risk and its effect on behaviour: A cross-national study. *Science of the Total Environment*, *407*(21), 5455–5464.

Dowling, G. R., & Staelin, R. (1994). A model of perceived risk and intended risk-handling activity. *Journal of Consumer Research*, *21*(1), 119–134.

Driedger, S. M., & Eyles, J. (2003). Different frames, different fears: Communicating about chlorinated drinking water and cancer in the Canadian media. *Social Science & Medicine*, *56*(6), 1279–1293.

Driedger, S. M., Mazur, C., & Mistry, B. (2013). The evolution of blame and trust: An examination of a Canadian drinking water contamination event. *Journal of Risk Research*, *17*(7), 837–854.

Dupont, D., Waldner, C., Bharadwaj, L., Plummer, R., Carter, B., Cave, K., & Zagozewski, R. (2014). Drinking water management: Health risk perceptions and choices in first nations and non-first nations communities in Canada. *International Journal of Environmental Research and Public Health*, *11*(6), 5889–5903.

Earle, T. C. (2010). Trust in risk management: A model-based review of empirical research. *Risk Analysis*, *30*(4), 541–574.

Edelenbos, J., & Eshuis, J. (2012). The interplay between trust and control in governance processes: A conceptual and empirical investigation. *Administration & Society*, *44*(6), 647–674.

Eiser, J. R., Miles, S., & Frewer, L. J. (2002). Trust, perceived risk, and attitudes toward food technologies. *Journal of Applied Social Psychology*, *32*(11), 2423–2433.

Fairbrother, M., Johansson Sevä, I., & Kulin, J. (2019). Political trust and the relationship between climate change beliefs and support for fossil fuel taxes: Evidence from a survey of 23 European countries. *Global Environmental Change*, *59*, 1–15.

Fessenden-Raden, J., Fitchen, J. M., & Heath, J. S. (1987). Providing risk information in communities: Factors influencing what is heard and accepted. *Science, Technology, & Human Values*, *12*(3/4), 94–101.

Fielding, K. S., Gardner, J., Leviston, Z., & Price, J. (2015). Comparing public perceptions of alternative water sources for potable use: The case of rainwater, stormwater, desalinated water, and recycled water. *Water Resources Management*, *29*(12), 4501–4518.

Fielding, K. S., Russell, S., Spinks, A., & Mankad, A. (2012). Determinants of household water conservation: The role of demographic, infrastructure, behavior, and psychosocial variables. *Water Resources Research*, *48*(10), 1–12.

Figueroa, M. E., & Kincaid, D. L. (2010). *Social, cultural and behavioral correlates of household water treatment and storage <http://ccp.jhu.edu/documents/Household%20Water%20Treatment%20and%20Storage%202010.pdf>*. Center Publication HCI-1: Health Communication Insights.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. *Policy Sciences*, *9*(2), 127–152.

Fragkou, M. C., & McEvoy, J. (2016). Trust matters: Why augmenting water supplies via desalination may not overcome perceptual water scarcity. *Desalination*, *397*, 1–8.

Freyer, B., Bingen, J., & Paxton, R. (2014). Can multicriteria assessment tools help build trust into organic products? *Ecology and Society*, *19*(4), 1–13.

Fukuyama, F. (1995). *Trust: The social virtues and the creation of prosperity*. Free Press.

Garcia-Cuerva, L., Berglund, E. Z., & Binder, A. R. (2016). Public perceptions of water shortages, conservation behaviors, and support for water reuse in the U.S. *Resources, Conservation and Recycling*, *113*, 106–115.

Gorelick, M. H., Gould, L., Nimmer, M., Wagner, D., Heath, M., Bashir, H., & Brousseau, D. C. (2011). Perceptions about water and increased use of bottled water in minority children. *JAMA Pediatrics*, *165*(10), 928–932.

Grafton, R. Q., Ward, M. B., To, H., & Kompas, T. (2011). Determinants of residential water consumption: Evidence and analysis from a 10-country household survey. *Water Resources Research*, *47*(8), 1–14.

Hobbs, J. E., & Goddard, E. (2015). Consumers and trust. *Food Policy*, *52*, 71–74.

Jakus, P. M., Shaw, W. D., Nguyen, T. N., & Walker, M. (2009). Risk perceptions of arsenic in tap water and consumption of bottled water. *Water Resources Research*, *45*(5), 1–8.

Jardine, C. G., Gibson, N., & Hrudey, S. E. (1999). Detection of odour and health risk perception of drinking water. *Water Science and Technology*, *40*(6), 91–98.

Jorgensen, B., Graymore, M., & O'Toole, K. (2009). Household water use behavior: An integrated model. *Journal of Environmental Management*, *91*(1), 227–236.

Kenney, D. S., Goemans, C., Klein, R., Lowrey, J., & Reidy, K. (2008). Residential water demand management: Lessons from Aurora, Colorado. *Journal of the American Water Resources Association*, *44*(1), 192–207.

Khalid, S., Murtaza, B., Shaheen, I., Ahmad, I., Ullah, M. I., Abbas, T., Rehman, F., Ashraf, M. R., Khalid, S., Abbas, S., & Imran, M. (2018). Assessment and public perception of drinking water quality and safety in district Vehari, Punjab, Pakistan. *Journal of Cleaner Production*, *181*, 224–234.

Khattab, A. A., Al-Shalabi, H., Al-Rawad, M., Al-Khattab, K., & Hamad, F. (2015). The effect of trust and risk perception on citizen's intention to adopt and use e-government services in Jordan. *Journal of Service Science and Management*, *8*(3), 279–290.

Lee, M. Y. (1981). Mandatory or voluntary water conservation: A case study of Iowa communities during drought. *Journal of Soil and Water Conservation*, *36*(4), 231–234.

Lee, M. Y., & Warren, R. D. (1981). Use of a predictive model in evaluating water consumption conservation. *JAWRA Journal of the American Water Resources Association*, *17*(6), 948–955.

Leong, C. (2015). A quantitative investigation of narratives: Recycled drinking water. *Water Policy*, *17*(5), 831–847.

Leong, C., & Lebel, L. (2020). Can conformity overcome the yuck factor? Explaining the choice for recycled drinking water. *Journal of Cleaner Production*, *242*, 1–7.

Li, L. (2004). Political trust in rural China. *Modern China*, *30*(2), 228–258.

Li, L., Araral, E., & Jeuland, M. (2019). The drivers of household drinking water choices in Singapore: Evidence from multivariable regression analysis of perceptions and household characteristics. *Science of the Total Environment*, *671*, 1116–1124.

Lindell, M. K., & Hwang, S. N. (2008). Households' perceived personal risk and responses in a multihazard environment. *Risk Analysis*, *28*(2), 539–556.

Lindgreen, A. (2003). Trust as a valuable strategic variable in the food industry: Different types of trust and their implementation. *British Food Journal*, *105*(6), 310–327.

Lobb, A. E., Mazzocchi, M., & Traill, W. B. (2007). Modelling risk perception and trust in food safety information within the theory of planned behaviour. *Food Quality and Preference*, *18*(2), 384–395.

Lu, L., Deller, D., & Hviid, M. (2019). Price and behavioural signals to encourage household water conservation: Implications for the UK. *Water Resources Management*, *33*(2), 475–491.

Marks, J. S., & Zadoroznyj, M. (2005). Managing sustainable urban water reuse: Structural context and cultures of trust. *Society & Natural Resources*, *18*(6), 557–572.

McGuire, M. J. (1995). Off-flavor as the consumer's measure of drinking water safety. *Water Science and Technology*, *31*(11), 1–8.

Merkel, L., Bicking, C., & Sekhar, D. (2012). Parents' perceptions of water safety and quality. *Journal of Community Health*, *37*(1), 195–201.

Mosler, H.-J. (2012). A systematic approach to behavior change interventions for the water and sanitation sector in developing countries: A conceptual model, a review, and a guideline. *International Journal of Environmental Health Research*, *22*(5), 431–449.

Newton, K., Stolle, D., & Zmerli, S. (2018). Social and political trust. In E. M. Uslaner (Ed.), *The Oxford handbook of social and political trust* (p. 37). Oxford University Press.

Onjala, J., Ndiritu, S. W., & Stage, J. (2014). Risk perception, choice of drinking water and water treatment: Evidence from Kenyan towns. *Journal of Water, Sanitation Hygiene for Development*, *4*(2), 268–280.

Ormerod, K. J., & Scott, C. A. (2013). Drinking wastewater: Public trust in potable reuse. *Science, Technology, & Human Values*, *38*(3), 351–373.

Osborne, M. J. (2004). *An introduction to game theory* (Vol. 3). Oxford University Press.

Pavlou, P. A. (2014). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, *7*(3), 101–134.

Peter, J. P., & Ryan, M. J. (1976). An investigation of perceived risk at the brand level. *Journal of Marketing Research*, *13*(2), 184–188.

Pidgeon, N. (1998). Risk assessment, risk values and the social science programme: Why we do need risk perception research. *Reliability Engineering & System Safety*, *59*(1), 5–15.

Pidgeon, N., Hood, C., Jones, D., Turner, B., & Gibson, R. (1992). Risk perception. In The Royal Society (Ed.), *Risk: Analysis, perception and management* (pp. 89–134). The Royal Society.

Pierce, G., & Gonzalez, S. (2017). Mistrust at the tap? Factors contributing to public drinking water (mis)perception across US households. *Water Policy*, *19*(1), 1–12.

Pierce, G., & Jimenez, S. (2015). Unreliable water access in US mobile homes: Evidence from the American housing survey. *Housing Policy Debate*, *25*(4), 739–753.

Po, M., Nancarrow, B. E., & Kaercher, J. D. (2003). *Literature review of factors influencing public perceptions of water reuse <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.197.423>* (Technical Report No. 54/03). CSIRO Land and Water, Perth.

Po, M., Nancarrow, B. E., Leviston, Z., Porter, N. B., Syme, G. J., & Kaercher, J. D. (2005). *Predicting community behaviour in relation to wastewater reuse: What drives decisions to accept or reject? <https://publications.csiro.au/rpr/pub?pid=procite:d8750bf3-2319-441b-a512-d97ddb757574>* Water for a Healthy Country National Research Flagship. CSIRO Land and Water, Perth.

Poortinga, W., & Pidgeon, N. F. (2005). Trust in risk regulation: Cause or consequence of the acceptability of GM food? *Risk Analysis*, *25*(1), 199–209.

Radcliffe, J. C. (2006). Future directions for water recycling in Australia. *Desalination*, *187*(1–3), 77–87.

Rathnayaka, K., Maheepala, S., Nawarathna, B., George, B., Malano, H., Arora, M., & Roberts, P. (2014). Factors affecting the variability of household water use in Melbourne, Australia. *Resources, Conservation and Recycling*, *92*, 85–94.

Raub, W., Buskens, V., & Van Assen, M. A. (2011). Micro-macro links and microfoundations in sociology. *The Journal of Mathematical Sociology*, *35*(1–3), 1–25.

Renner, B., Schupp, H., Vollmann, M., Hartung, F.-M., Schmälzle, R., & Panzer, M. (2008). Risk perception, risk communication and health behavior change: Health psychology at the University of Konstanz. *Zeitschrift für* Gesundheitspsychologie, *16*(3), 150–153.

Rodríguez-Tapia, L., Revollo-Fernández, D. A., & Morales-Novelo, J. A. (2017). Household's perception of water quality and willingness to pay for clean water in Mexico City. *Economies*, *5*(2), 12.

Ross, V. L., Fielding, K. S., & Louis, W. R. (2014). Social trust, risk perceptions and public acceptance of recycled water: Testing a social-psychological model. *Journal of Environmental Management*, *137*, 61–68.

Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, *23*(3), 393–404.

Scherer, C. W., & Cho, H. (2003). A social network contagion theory of risk perception. *Risk Analysis*, *23*(2), 261–267.

Schmidt, W.-P., & Cairncross, S. (2009). Household water treatment in poor populations: Is there enough evidence for scaling up now? *Environmental Science & Technology*, *43*(4), 986–992.

Sims, J. H., & Baumann, D. (1974). Renovated waste water: The question of public acceptance. *Water Resources Research*, *10*(4), 659–665.

Skuras, D., & Tyllianakis, E. (2018). The perception of water related risks and the state of the water environment in the European Union. *Water Research*, *143*, 198–208.

Slovic, P. (1987). Perception of risk. *Science*, *236*(4799), 280–285.

Spence, N., & Walters, D. (2012). "Is it safe?" Risk perception and drinking water in a vulnerable population <https://ir.lib.uwo.ca/iipj/vol3/iss3/9>. *International Indigenous Policy Journal*, *3*(3), 9.

Stenekes, N., Colebatch, H. K., Waite, T. D., & Ashbolt, N. J. (2006). Risk and governance in water recycling: Public acceptance revisited. *Science, Technology, & Human Values*, *31*(2), 107–134.

Stone, R. N., & Winter, F. W. (1987). *Risk: Is it still uncertainty times consequences?* [Conference presentation]. Proceedings of the American Marketing Association, Winter Educators Conference, Chicago, IL.

Sztompka, P. (1999). *Trust: A sociological theory*. Cambridge University Press.

Tortajada, C., González-Gómez, F., Biswas, A. K., & Buurman, J. (2019). Water demand management strategies for water-scarce cities: The case of Spain. *Sustainable Cities and Society*, *45*, 649–656.

Vincent-Wayne, M. (1999). Consumer perceived risk: Conceptualisations and models. *European Journal of Marketing*, *33*(1/2), 163–195.

Volland, B. (2017). The role of risk and trust attitudes in explaining residential energy demand: Evidence from the United Kingdom. *Ecological Economics*, *132*, 14–30.

Wang, R. Y., Si, Z., Ng, C. N., & Scott, S. (2015). The transformation of trust in China's alternative food networks: Disruption, reconstruction, and development <http://dx.doi.org/10.5751/ES-07536-200219>. *Ecology and Society*, *20*(2), 19.

Wang, Y. (2017). Government trust in risk society governance: An explanatory framework of risk perception [in Chinese]. *Jiangxi Social Sciences*, *2*, 237–247.

Weber, E. U. (2001). Risk: Empirical studies on decision and choice. In N. J. Smelser & P. B. Baltes (Eds.), *International encyclopedia of the social & behavioral sciences* (pp. 13347–13351). Pergamon.

Weinstein, N. D. (1999). What does it mean to understand a risk? Evaluating risk comprehension. *JNCI Monographs*, *1999*(25), 15–20.

Willis, R. M., Stewart, R. A., Panuwatwanich, K., Williams, P. R., & Hollingsworth, A. L. (2011). Quantifying the influence of environmental and water conservation attitudes on household end use water consumption. *Journal of Environmental Management*, *92*(8), 1996–2009.

Wray, R., Rivers, J., Jupka, K., & Clements, B. (2006). Public perceptions about trust in emergency risk communication: Qualitative research findings. *International Journal of Mass Emergencies and Disasters*, *24*(1), 45.

Zhang, H. H., & Brown, D. F. (2005). Understanding urban residential water use in Beijing and Tianjin, China. *Habitat International*, *29*(3), 469–491.

Zhang, W., & Ke, R. (2002). Trust in China: A cross regional analysis. *Economic Research Journal*, *10*, 59–70.

Zhen, N., Barnett, J., & Webber, M. (2019). Trust and the risk of consuming polluted water in Shanghai, China. *Journal of Risk Research*, *22*(1), 55–66.

Zucker, L. G. (1986). Production of trust: Institutional sources of economic structure, 1840–1920. *Research in Organizational Behavior*, *8*, 53–111.

Related Articles

How Perceptions of Risks Affect Responses to Climate Change: Implications for Water Resources Planning

Behavioral Interventions as Policy Instruments to Manage Household Water Use