

Methods of conducting effective outreach to private well owners – a literature review and model approach

Lucinda Morris, Steve Wilson and Walton Kelly

ABSTRACT

Educational outreach programs have the potential to increase the occurrence of private well testing and maintenance behaviors, but are not always able to successfully engage the intended audience and overcome their barriers to change. We conducted a review of literature regarding behavior change and risk communication to identify common barriers to private well stewardship and motivational strategies to encourage change, as well as best practices for communicating with well owners. Results indicated that no specific strategy will be appropriate for all audiences, as different groups of well owners will have different barriers to change. For this reason, educators must develop an understanding of their audience so they are able to identify the most significant barriers to change and select motivational strategies that will directly reduce barriers. Implications for private well outreach programs are discussed.

Key words | behavior, communication, education, outreach, private wells, stewardship

Lucinda Morris
Steve Wilson (corresponding author)
Walton Kelly
Illinois State Water Survey at the Prairie Research
Institute, Groundwater Section,
University of Illinois at Urbana-Champaign,
2204 Griffith Drive,
Champaign,
IL 61820,
USA
E-mail: sdwilson@illinois.edu

INTRODUCTION

Private well owners are solely responsible for the care and maintenance of their own wells, yet few of them choose to test their well water (Pyrch 1999; Hexemer *et al.* 2008). Well owners give a wide variety of reasons for not performing stewardship activities, and educational efforts are not always able to successfully overcome those reasons so that testing increases (Imgrund *et al.* 2011). Coordinators of private well outreach programs could greatly benefit from having a better understanding of how to effectively engage well owners and encourage them to test their well regularly. To investigate the approaches used by private well outreach programs, we conducted a survey of outreach program staff and collected information regarding the methods that have been most successful at engaging and influencing well owners. As an extension of this effort, we also conducted a review of behavior change and communication health literature to identify approaches that have been utilized to reach individuals and influence behavior.

Outreach programs that seek to influence human behavior have been designed to address a variety of audiences

using a wide selection of strategies. Many of these programs have successfully changed behaviors, while others have failed to engage their audience and yielded few to no positive results. These results, whether positive or negative, provide educators with valuable information for creating or modifying their own outreach programs. Outreach specifically designed to address well owners presents a unique set of challenges. Private well owners are a diverse group of individuals that come from many backgrounds, and for this reason there is no 'one size fits all' approach to educating them about the risks they possibly face from drinking untested groundwater. Because of the nature of groundwater, private well owners living in different parts of the country, or even on opposite sides of town, might have different threats to the quality of their drinking water and will require different approaches to adequately educate them about the risk to their well.

To investigate the various characteristics of successful public outreach programs, we conducted a literature review to identify barriers to and motivations for behavior

doi: 10.2166/wh.2015.081

change, as well as risk communication best practices as they relate to private well owner outreach and education. Results from a broad selection of fields were evaluated to identify approaches that would specifically benefit outreach to private well owners, but these findings should also be effective for a variety of audiences and health applications.

It is important to acknowledge that educators have their own barriers to overcome when conducting outreach, both separate from and in addition to the well owner barriers discussed in this paper. Limited funding for face-to-face programs, other cost restrictions, shifting program priorities, and loss of trained staff will all affect the educators' ability to implement the approaches provided here. We mention this for completeness, but realize that a separate paper is needed to adequately address the unique challenges and potential solutions educators are facing and will not attempt to examine the issue in this paper.

METHOD FOR SELECTING PAPERS

Published documents for this review were retrieved from several online scientific journal databases using a large combination of search terms concerning private wells, behavior change, and effective communication (Table 1). Additional related studies were identified by searching the reference sections of papers obtained during the preliminary online

Table 1 | Online journal databases and search terms utilized to locate documents for this review

Databases	Search terms
BioMed Central	Attitude change, behavior change (barriers, communication, messages, motivations, education), communication best practices, crisis communication, customized communication, domestic well, drinking water, educational outreach, environmental behavior, health (behavior, campaign, communication, information, intervention, promotion), healthy behavior, private well (behavior, best practices, health, information, intervention, outreach, program, stewardship, testing), public (attitude, behavior, education, health), risk (communication, messages, perception), stewardship behavior, water (behavior, health, stewardship, well)
IWA Publishing	
JAWRA	
Journal of Extension	
PubMed	
Sage Publications	
ScienceDirect	
Springer	
Taylor & Francis	
Wiley Online Library	

search, resulting in an initial compilation of over 300 documents.

From this list, documents were selected based on subject matter and strength of studies, and were required to present information relevant to behavior change or risk communication. The final selection of documents draws information from many fields of study and discusses numerous communication best practices as well as factors influencing individual behaviors. Although this literature review is not exhaustive, we attempted to select the most pertinent studies on each topic in order to develop a pool of resources that are informative and provide a considerable depth and breadth of ideas and concepts. Because the focus was on identifying barriers, motivations, and best practices, when multiple papers provided similar data, only one or two of those papers were cataloged and included.

CLASSIFICATION OF INFORMATION

Our literature review focused on three main categories: barriers to behavior change, motivations to change behavior, and risk communication best practices. Topics were arranged into subcategories within each category based on the similarity of their subject matter, specifically relating to the manner in which the topic addresses personal behavioral decisions or the process of risk communication (Table 2).

Topics in the motivation and barrier categories were assigned to the same four subcategories: (1) knowledge and information, (2) risk perception, (3) convenience/inconvenience, and (4) personal and social. Subcategories were determined based on how the topics address behaviors and behavior change. For example, the knowledge and information subcategories relate to an individual's overall grasp of complete and correct information, or lack thereof. The other subcategories were determined in a similar manner, based on the distinct behavioral responses within each topic.

Topics in the risk communication category were organized based on their role in the risk communication process. A total of three subcategories were developed that must be considered to facilitate proper communication efforts: understanding the audience, methods of creating and disseminating messages, and best practices for planning

Table 2 | Classification of information and examples of topics that fall under each category

Main categories	Subcategories	Example topics
Barriers	Knowledge and Information	Lack of knowledge, contradictory messages
	Risk Perception	Neighbors, previous personal experience
	Inconvenience	Lack of time, constraints in rural communities
Motivations	Personal and Social	Social norms, complacency, false sense of security
	Knowledge and Information	Public education, single-session workshops
	Risk Perception	Fear appeals, known sources of local risk
Communication	Convenience	Recommendations, incentives, prompts
	Personal and Social	Commitments, social norms, early adopters
	Understand the Audience	Knowledge and attitudes, appropriate media
	Creating Messages	Tailored/framed messages, multi-media approach
	Outreach Best Practices	Identify spokesperson, build partnerships

the communication process, and were classified by their role in developing effective communication campaigns.

BARRIERS TO BEHAVIOR CHANGE

To succeed, outreach programs should identify and address specific barriers that impede private well testing and stewardship. Programs should be designed to directly reduce the main barriers to change so that adoption of new behaviors is more likely to occur (Figure 1) (Hexemer et al. 2008). The correct identification of barriers to behavior change within the target audience will allow educators to more effectively engage the audience and teach new concepts (McKenzie-Mohr & Schultz 2014). Educators who are not able to connect with the audience and reduce barriers to change will not be successful at implementing changes in well owner attitudes toward testing and stewardship.

and conducting outreach campaigns. Understanding the audience was a prevalent topic in many of the resource documents, and – given its determinative role in the success of outreach efforts – warranted a dedicated discussion. The additional subcategories discuss other factors involved in

Knowledge and information barriers

One of the primary barriers to behavior change is an individual’s knowledge or lack of knowledge regarding a given topic or behavior. Knowledge plays a large role in shaping behavior, as individuals who do not understand the necessity for behavior change will likely not understand the

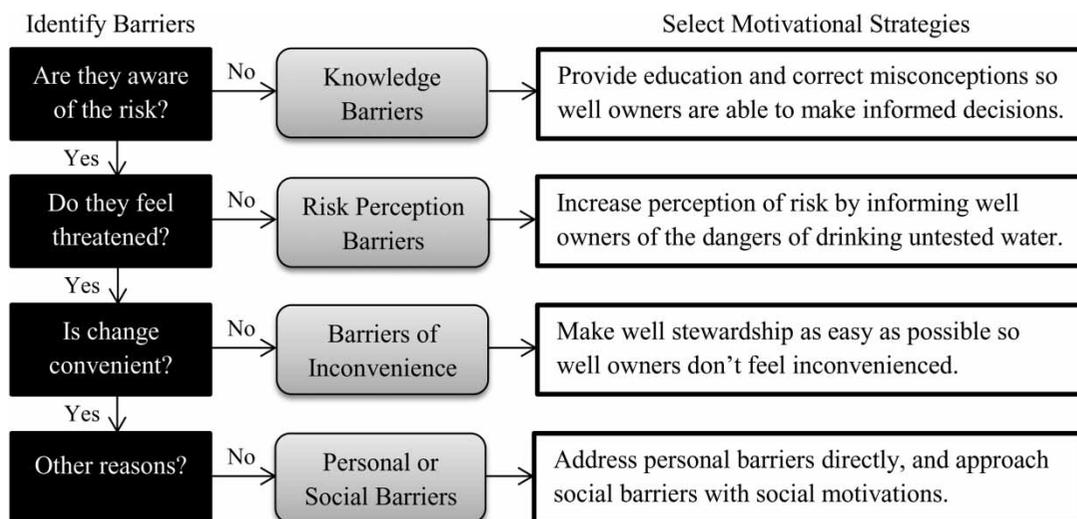


Figure 1 | Selection of appropriate motivational strategies through identification of significant barriers.

benefits that can come from adopting a new behavior and will not change (Imgrund *et al.* 2011). Even those who are motivated to change can be influenced by a lack of knowledge because individuals without the proper educational background will not have the procedural knowledge necessary to comply with new behaviors (Cook & Berrenberg 1981; Frisch *et al.* 2013; Naughton & Hynds 2014). Private well owners who do wish to test their water are often faced with a series of choices, such as where to get their water tested or what parameters to test for (Pyrch 1999; Jones *et al.* 2005). While this barrier may seem minor to some, it can be a considerable challenge to overcome for those who are unsure who to consult for help or how to make these decisions on their own. Individuals who are not familiar with common water contaminants or the testing process are unable to make informed choices, and this can be enough to deter them from testing (Pyrch 1999).

Contradictory messages can amplify the barriers posed by lack of knowledge by increasing public confusion, which increases their resistance to behavior change because they are unsure which information is correct (Fitzgibbon *et al.* 2007; Nagler 2014). Individuals can frequently encounter conflicting information in the media, and confusion about benefits or risks associated with a behavior will lead many to believe that the professionals are also unsure what is correct (Meijers & Rutjens 2014; Nagler 2014). Changing information that has been in place for years may require special attention, as it will often be met with confusion and resistance (Hanchett *et al.* 2002; Nagler 2014). For example, when the maximum contaminant level for arsenic in drinking water was revised by the outgoing Clinton administration in 2001, the scientific validity of this change was publicly questioned by the incoming administration. Mass media covered both sides of the argument, leaving members of the public confused about whether the change was necessary (Severtson *et al.* 2006). Even after it was adopted, private well owners were left to choose whether they wanted to evaluate their water quality based on the old or the new standard. Because of the confusion caused by the public questioning, some well owners with unsafe levels of arsenic in their water continued to use the old standard that they still believed to be valid (Severtson *et al.* 2006).

Both a lack of knowledge and conflicting information can lead individuals to form inaccurate beliefs, which –

because people make choices based on what they believe to be true – can lead to harmful decisions (Summers 2010). Well owners are generally confident that they understand the way their well works, but this confidence is often based on inaccurate beliefs. Individuals who do not think it is necessary to engage in regular stewardship activities are more likely to believe inaccurate information about contaminants and recommended testing frequencies (Summers 2010; Roche *et al.* 2013). Similarly, improper use of treatment devices with well water is an example of inaccurate understanding, and often leads well owners to assume their water is safe to drink when it may not be (Roche *et al.* 2013). Well owners who inadvertently install incorrect treatment systems – often as a result of insufficient knowledge or bad advice – will frequently assume that they are removing harmful contaminants from their water. This inaccurate belief in the function of the treatment system will make well owners less likely to test their water, even though the presence of the treatment device does not guarantee that the water is safe to drink (Flanagan *et al.* 2015a). Improper treatment systems may be treating for the wrong contaminant or may not work correctly because they are not being properly maintained, but because the water is assumed to be safe the well owner may not realize that they are still at risk (Jones *et al.* 2006; Roche *et al.* 2013).

Risk perception barriers

A significant predictor of whether an individual will adopt a preferred behavior is the manner in which they perceive the risk associated with their current behavior. The method individuals use to determine their perception of risk can be problematic because people tend to have trouble identifying personal risk, especially when it comes to private wells (Summers 2010). Well owners with low perceived risk generally will not get their water tested or take any action to reduce risk, particularly in countries with reliable water supplies where most individuals think their water is safe (Gordon 2002; Doria 2010). A well owner's perception of risk paired with the aesthetic properties of their water will play a significant role in determining the manner in which they perceive their water quality. Although many harmful contaminants will not have a noticeable effect on aesthetic properties, the quality of water is often judged based on

sensorial information, such as taste, odor or color (Doria *et al.* 2009; Doria 2010). If there are no noticeable changes in aesthetics, well owners will often perceive their water quality to be good (Doria 2010; Roche *et al.* 2013). Thus, they likely will not feel threatened by potential contamination issues and will be less willing to dedicate time and money to test their water.

Conditions that exist in close proximity to an individual will often influence their perception of a given risk because risks that are nearby seem more relevant, while risks that occur at a distance are less threatening. For private well owners, the quality of water at a neighbor's house will influence their perception of the quality of their own drinking water (Chappells *et al.* 2015). If there are no contamination issues in a neighborhood, then homeowners often make the assumption that the groundwater is safe to drink and testing their water is unnecessary (Jones *et al.* 2005). Well owners who are unaware of the way contaminants enter and travel through groundwater are particularly susceptible to making this assumption, as they do not have the proper knowledge to understand that they may still be at risk. Although many well owners report that they would get their water tested if a neighbor's well was contaminated (Pyrch 1999; Jones *et al.* 2005; Severtson *et al.* 2008), sometimes being a couple of blocks away from a contaminated well is far enough to feel safe (Chappells *et al.* 2015; Flanagan *et al.* 2015b). Neighbors have a marked impact on an individual's perception of risk, but they can also constrain behavior change by exerting social pressure on an individual (Summers 2010). Generally, homeowners believe that their neighbors are not testing their water and consequently do not feel the need to test their own water (Flanagan *et al.* 2015b).

Additionally, perception of risk can be influenced by previous experiences, as encountering a risk without sustaining any personal damage may lead people to believe they are protected against future occurrences (Fitzpatrick-Lewis *et al.* 2010). Past encounters with risk set a standard that individuals will grow accustomed to, and any deviation from this standard, whether good or bad, will likely be met with a desire to return to the preferred standard. This standard will be used as a basis for future interpretations of water quality information and will define the water quality parameters that an individual judges to be most preferable (Doria 2010). Private well owners who have gone years

without testing their water and have never experienced health problems often think this is proof of safe water, which is enough of a reason for them to continue choosing not to test (Imgrund *et al.* 2011; Flanagan *et al.* 2015b). On the other hand, well owners who have tested their water in the past and always received good results often believe testing is unnecessary, as the consistently good results make repeated testing seem like a waste of time and money (Jones *et al.* 2005, 2006). Past encounters in which an individual was not harmed or was informed that they were not at risk will decrease their perception of risk, which in turn will decrease the likelihood that they will be motivated to adopt more protective behaviors (Jones *et al.* 2005).

Barriers of inconvenience

Inconvenience is a very common reason given by well owners for why they do not test their well more regularly (Pyrch 1999; Hexemer *et al.* 2008; Chappells *et al.* 2015). Factors such as travel requirements can be significant barriers to private well testing, as the distance to and operating hours of testing laboratories can make picking up and dropping off sample bottles inconvenient (Jones *et al.* 2005, 2006; Imgrund *et al.* 2011; Roche *et al.* 2013). This is especially problematic when it requires well owners to take time away from their job and make a special trip to the testing laboratory. Residents of rural communities who live a long distance from testing locations are greatly impacted by this barrier (Jones *et al.* 2005), and the unique constraints they face will be discussed later. In order to maximize adoption of good stewardship practices, outreach efforts must strive to reduce any inconveniences associated with the new behaviors (Hexemer *et al.* 2008). For private well testing, this could be anything from offering people mail-in test kits or sample pick-up services, to informing them that testing does not require an exorbitant amount of time or effort.

The potential financial cost of implementing a new behavior can occasionally be enough of an inconvenience to prevent change (McCann & Gold 2012). Removing the barrier of cost can be effective at prompting well owners to test at least once (Hexemer *et al.* 2008), but cost often constrains other well-related duties that are more difficult to overcome. For example, the potential cost of treating a well upon testing it and discovering a contamination issue

can be an expensive process that some well owners may not be able to afford (Straub & Leahy 2014; Flanagan *et al.* 2015a). Overall, the financial costs associated with private well maintenance and testing represent a significant barrier to good stewardship behaviors that must be addressed by outreach programs.

As mentioned previously, constraints in rural communities can make the implementation of behavior change programs more challenging. Before beginning an outreach program in a rural setting, it is necessary to build trust within the community in order to maximize participation, as some residents can be resistant to ‘outsiders’ (Balamurugan *et al.* 2007). Many people have a general lack of trust in government officials and a fear of losing control of decisions regarding their well (Pyrch 1999), such as the belief held by some that if your well is contaminated, the government will require you to treat the water and test more regularly (Jones *et al.* 2005). To overcome this barrier there needs to be more trust between the community and community leaders, and individuals should be educated about what the government can and cannot do with private wells (Pyrch 1999). To increase testing in rural communities, outreach efforts must establish trust or be delivered by someone the audience already trusts so that residents will listen to their message, which takes time and resources (Balamurugan *et al.* 2007). In addition, these efforts have to remove significant barriers to testing, which frequently include inconveniences such as the distance to testing locations (Mancl *et al.* 1989; Chappells *et al.* 2015).

Personal or social barriers

Influences from an individual’s social environment will play a significant role in determining their behavior, as people typically choose to conform to the beliefs of their social group rather than comply with scientific recommendations (Gordon 2002; Campo *et al.* 2013; McKenzie-Mohr & Schultz 2014). Norms can give individuals a reason to resist change, as deviation from the norm is often associated with social punishment in the form of disapproval from one’s peers (Summers 2010). Regarding private well stewardship, there are many beliefs and practices that are accepted by the general public, meaning that there is little to no social pressure for well owners to engage in any specific

stewardship activities (Summers 2010). Overall, there is a very low testing norm in many communities, as homeowners do not believe that their neighbors are testing and do not feel that their peers expect them to test (Flanagan *et al.* 2015b). To increase testing behavior, educators must seek to make stewardship behavior the norm, which will require consistent education and construction of clear normative messages (Cialdini 2003; Kennedy 2010).

In the absence of strong social influence, well owners who have not experienced illnesses from drinking their water generally will not see a reason to test for contaminants (Roche *et al.* 2013). This barrier becomes more significant over time, as the longer an individual has been drinking from a well without suffering any health consequences, the less concerned they are about water quality and the less likely they are to get the water tested (Severtson *et al.* 2006; Flanagan *et al.* 2015b). This behavior is particularly ill-advised for private well owners, because some of the health effects associated with certain contaminants will not be immediately apparent. Arsenic is a prime example of a naturally-occurring contaminant which typically does not cause noticeable health problems until years after individuals begin drinking the water (Hanchett *et al.* 2002; Madajewicz *et al.* 2007). Private well owners who judge their water quality based on their current health may be overlooking contaminants that are causing long-term harm, and waiting to test until obvious health effects appear can lead individuals to drink contaminated water for years (Chappells *et al.* 2015; Flanagan *et al.* 2015a).

Even well owners who are aware that testing is recommended will choose not to test, especially if there are no aesthetic issues and they are not unhealthy. This complacency occurs because many well owners are confident that their water is safe to drink, even when they have no test results to support that claim and do not perform preventative maintenance on their well (Jones *et al.* 2005; Summers 2010). Complacency among well owners is an issue that can be difficult to overcome, as many individuals will acknowledge that they should be testing and are aware of the risks but choose instead to be content with the water they have, developing a false sense of security (Imgrund *et al.* 2011). Outreach programs must address complacency directly and provide well owners with enough information

and support to transform unjustified satisfaction into informed attentiveness (Kreutzwiser *et al.* 2011).

STRATEGIES TO MOTIVATE BEHAVIOR CHANGE

Once the barriers to change have been identified, educators must decide which motivational strategies will be most effective at encouraging well owners to properly maintain and test their wells (Figure 1). The selection of strategies should be based on a number of factors, such as audience characteristics and specific barriers to change (Schultz 2014), meaning that outreach program design will vary. Motivational strategies provide the methodology to overcome barriers, giving individuals additional reason to adopt new behaviors.

Increasing knowledge and awareness

One of the most important strategies influencing the success of an outreach campaign involves raising awareness and knowledge of the issue. Public education programs should inform the audience about risk, how they may be harmed, and what they should do to avoid or fix it (Pyrch 1999; Fox *et al.* 2006). Although information alone is usually not enough to change behavior, it provides a crucial context which allows individuals to understand the risks and why they are threatening, making them more likely to take protective action (Jalan & Somanathan 2008; Roche *et al.* 2013; Schultz 2014). To increase the likelihood of educational programs yielding behavior change, specific knowledge and skills essential to supporting new behaviors – such as how to properly take a water sample – must be emphasized to create a foundation for the behavior (Pratt & Bowman 2008). Outreach programs designed to address private well owners specifically must provide easy-to-understand information so that well owners are able to evaluate their own water quality and make informed decisions (Severtson *et al.* 2004; Atilas 2005). For example, well owners generally desire specific, customized information about water testing, such as what to test for, where to test, and how much it will cost (Jones *et al.* 2005). Programs that respond to audience needs and concerns will be the most effective at engaging the audience and increasing acceptance of the take-home message.

Single-session workshops have been successful at educating well owners and influencing the adoption of water testing behaviors (Swistock *et al.* 2001; McCann & Gold 2012). These workshops are a great opportunity to provide information about risk and behavior change, and give educators the ability to teach attendees about risk assessment techniques they can perform on their own at home (Mancl *et al.* 1989; McCann & Gold 2012). Workshops that are interactive and provide community-specific information are especially effective at engaging the audience. Hands-on learning gives individuals the opportunity to participate in lessons and develop a full understanding of the material, which often translates to greater support from the audience (Parkinson *et al.* 2003). Bringing educational props to private well workshops allows well owners to learn important concepts about their water system and how to properly care for it (Uhlman & Artiola 2010). If the workshop does not allow for hands-on learning, educators can utilize demonstrations to increase the likelihood that new behaviors will be adopted. Conducting a demonstration of the behavior will send a vivid message home that people will remember, and will also give audience members a better idea of how to successfully comply with the new behavior (Frahm *et al.* 1996; Briscoe & Aboud 2012).

While education is certainly a good place to start, it will not always be able to reach the intended audience on its own. Outreach programs that only provide information are much less likely to succeed at changing behavior than programs that utilize multiple approaches to engage well owners (Briscoe & Aboud 2012). Multiple techniques create more opportunities for participants to get involved, especially if the techniques are selected based on audience characteristics, and outreach programs will be greatly enhanced if they do not rely exclusively on a single approach (Kennedy 2010; Briscoe & Aboud 2012). The following sections discuss various techniques to change behavior that can be utilized in addition to providing educational programming.

Increase perception of risk

Perception of risk is a factor that can either constrain behavior or facilitate a change in behavior. Well owners who perceive a risk to be personally threatening will be much more likely to attend educational sessions and test their

water, especially if they have experienced contamination or health issues in the past (Imgrund *et al.* 2011; Flanagan *et al.* 2015b). Previous experiences, while capable of impeding behavior change, can make individuals more aware of risk and more receptive to information from professionals (Atwood & Major 1998; Fitzpatrick-Lewis *et al.* 2010). Also acting as both a motivation and barrier to change, water quality issues within a neighborhood make the risk of contamination more relevant, and can prompt other well owners nearby to test their water (Pyrch 1999; Chappells *et al.* 2015; Flanagan *et al.* 2015b). Private well outreach programs can increase perceptions of risk by appealing to any of these concerns, which will make well owners more aware of their water quality and more willing to learn how to protect it.

Rather than waiting for perception of risk to increase naturally (e.g., after a contamination issue or personal experience), educators can attempt to enhance it with fear appeals. Messages that utilize fear appeals aim to scare people into action by providing information that makes individuals feel that their safety is being threatened (Nestler & Egloff 2010; Morales *et al.* 2012). Strong fear appeals can be very effective at changing behavior when coupled with high-efficacy messages, because they arouse high levels of fear while making people feel that they are capable of protecting themselves from harm (Witte & Allen 2000). However, although fear appeals can yield fairly high rates of success, they are not always successful because individuals who prefer to avoid unpleasant emotions are likely to ignore the message (Witte & Allen 2000; Nestler & Egloff 2010). Private well outreach programs can utilize fear appeals by informing well owners of the health effects associated with certain contaminants, but it is important to do so subtly as overuse of fear appeals will drive many people away (Jones *et al.* 2006).

Alternatively, educational outreach can increase perception of risk by making people more aware of the risks that exist in their neighborhood or community. Individuals are more likely to be concerned about their health if they live in the vicinity of known sources of environmental contamination, such as industrial facilities (Pyrch 1999). Providing additional information regarding the significance of the risk and how it might affect their health will make them more aware of the necessity to adopt protective behaviors

(Bettinger 2012). For private well owners, having a septic tank near their well can motivate them to test their water if they are made aware of the potential risk of contamination (Castelnuovo 1999; Pyrch 1999; Naughton & Hynds 2014). Outreach efforts can also motivate well owners by informing them of known contamination issues that are present in their community, as pairing educational offerings with localized risk information will often motivate many individuals to take action (Bettinger 2012). In some cases, information about contamination is provided to the public by the media. These instances can sometimes create panic, which motivates well owners to take action to protect their well-being. This provides educators with a 'teachable moment', which can be very effective at overcoming barriers and influencing well owner behavior (Cohen *et al.* 2011).

Increase convenience

In some cases, even individuals who have an accurate perception and awareness of risk will still choose not to change their behavior because it is inconvenient for them to do so (Schultz 2014). Given this, private well outreach programs can increase adoption of good stewardship practices by making them more convenient (Kreutzwiser *et al.* 2011). The potential inconvenience or discomfort of changing behavior is important to many people, so educators must strive to increase the desirability of new behaviors and decrease the convenience of old behaviors (Cook & Berrenberg 1981; McKenzie-Mohr & Schultz 2014). To increase water testing, offering sample pick-up services, extending drop-off hours, or providing home test kits makes the process more convenient, especially for residents of rural communities (Jones *et al.* 2005, 2006; Imgrund *et al.* 2011; Roche *et al.* 2013). Behavior change should be as easy and painless as possible, and increasing the convenience of complying will help override personal variables such as attitudes and beliefs.

Making specific recommendations is one strategy that can be useful in influencing how an individual will act, because it eliminates the need for them to decide how they should respond to information (Frisby *et al.* 2014). Educational sessions that provide the audience with suggested behaviors as well as how to comply can successfully prompt some individuals to take action (Gonzales *et al.*

1988; Fox *et al.* 2006), but these behaviors must be both feasible and specific in order to be most effective (Cook & Berrenberg 1981). For example, educators can provide private well owners with recommendations regarding how often they should be testing their water, what they should be testing for, and where they can send their samples. Providing these recommendations in written form will make them more convenient to remember and follow, further increasing the likelihood of compliance (McCann & Gold 2012).

Offering incentives can be an effective method of increasing use of new behaviors, as individuals will often be more eager to change to obtain the incentive (Cook & Berrenberg 1981). To be most effective, incentives should directly reduce barriers and be paired closely with the new behavior (Kennedy 2010). For example, if the cost of getting a water sample tested is a barrier to change, incentives that remove the cost will increase compliance. Although financial incentives can be very successful at influencing behavior, they also reduce the probability of long-term change because people will often revert back to the old behavior once the incentive is no longer offered (Frahm *et al.* 1996; McKenzie-Mohr & Schultz 2014; Schultz 2014). To avoid this behavior, incentives should be offered on an annual basis. Private well outreach programs that offer yearly incentives can successfully encourage individuals to get their water tested as well as provide a reminder to test annually (Straub & Leahy 2014).

Reminders to engage in a new behavior can successfully increase compliance, even when not paired with an incentive, because they raise awareness and let people know that an opportunity exists to comply (Cook & Berrenberg 1981; Prestwich *et al.* 2010). Although prompts on their own generally do little to change public opinion or attitude, they remind individuals to engage in activities that might have otherwise been forgotten, thus overcoming barriers such as procrastination (McKenzie-Mohr & Schultz 2014; Schultz 2014). One-time reminders can be useful for reminding individuals to comply once, but typically are not enough to change ingrained behaviors. The goal is to make private well testing and maintenance habitual so that well owners do not need to consciously think about compliance, which can be accomplished by providing reminders until they aren't needed anymore (Jones *et al.* 2005; Kreutzwiser

et al. 2011). Once the new behavior becomes a habit, individuals will no longer feel that it is an inconvenience because it is part of their routine.

Personal or social motivations

Personal barriers to behavior change (e.g., complacency, false sense of security) can be difficult to overcome because individuals with these barriers are often aware of the recommendation to change, and may even agree with it, but have reasons for not doing so. Thus, educational outreach alone may not be enough to persuade them to change, and should be supplemented with other strategies to increase the likelihood of success, such as commitments. Commitments give individuals a sense of obligation to follow through with their stated goals, which will increase the likelihood that they act on their intentions (Gonzales *et al.* 1988; McKenzie-Mohr & Schultz 2014). The most successful commitments tend to be specific and public, because they are accompanied by a sense of social expectation (Deleon & Fuqua 1995; Schultz 2014), but private commitments will also increase the chances of change (Cook & Berrenberg 1981; McKenzie-Mohr & Schultz 2014). Outreach programs can utilize commitments simply by asking well owners to confirm that they intend to test their water. This verbal acknowledgement of their intention can increase the likelihood that an individual will test because they feel compelled to be consistent (McKenzie-Mohr & Schultz 2014).

Social norms can act as either a barrier or a motivation to behavior change. Overcoming social barriers can be difficult, as it requires educators to convince individuals that their perception of the norm is incorrect, which will often be met with resistance (Summers 2010). In the absence of social norms that lead behavior in the preferred direction, educators can attempt to utilize the power of social influence to guide behavior by crafting normative messages that address a topic in relation to how it is regarded by the public (Cialdini 2003). Although normative messages can be effective at changing behavior, they have the potential to backfire and confuse the audience if not constructed properly (Cialdini 2003; Kennedy 2010; McKenzie-Mohr & Schultz 2014). To avoid this, communicators must understand the difference between what people do, and what

they approve or disapprove of, so they are able to send the message that the target behavior is both socially acceptable and widespread (Cialdini 2003; Schultz 2014). For well owners, there is generally a very low testing norm, as they do not believe their peers are testing and do not feel that their peers expect them to test (Summers 2010; Flanagan et al. 2015b). Normative messages directed specifically to the private well community could be effective at increasing this norm and making well owners think that others in their social network are testing and expect them to test as well.

Alternatively, outreach campaigns can attempt to influence the social environment by first teaching the new behavior to a few respected members in the target community. These change agents will spread the message through their social networks, changing beliefs and behaviors in the community through a process of diffusion (Frahm et al. 1996; Summers 2010). Targeting small groups like this can be resource intensive, but will often benefit outreach programs in the long run because each new adopter will influence people in their own social groups and assist in spreading the message (Clemens 2007; Summers 2010). Utilizing trusted, local sources to help spread new ideas will be better received by the audience and increase message acceptance (Summers 2010), especially in rural communities where residents might be resistant to ‘outsiders’ (Hanchett et al. 2002). The Master Well Owner Network run by Penn State Cooperative Extension is an example of a program that utilizes change agents to spread information about private wells. Volunteers attend a training session and are provided with the resources necessary to conduct their own educational sessions on their own time in their own local area. By training individuals from around the state, Penn State Extension is able to spread their message of private well stewardship to rural communities that they would not have been able to reach using traditional methods (Clemens 2007).

RISK COMMUNICATION BEST PRACTICES FOR ENGAGING WELL OWNERS

An effective communicator must be honest, knowledgeable, interesting, and available to their audience. Communication

with the public will play a large role in shaping their attitude towards a given risk, and will help ensure that they know how to protect themselves from harm (USHHS 2002). A firm understanding of the principles of effective communication determines whether educators are able to engage their audiences, and is essential to the success of any outreach program.

Understand your audience

Communicators and educators alike must have an understanding of audience characteristics in order to develop outreach programs that are relevant and engaging (Figure 2). Professionals will need to learn about the audience in advance of communication to determine their needs, concerns, and interests, find out how much they know about the topic, what their attitude is towards it, and identify their barriers to change (Frahm et al. 1996; Bier 2001; Jacob et al. 2010; Steelman & McCaffrey 2013). Assessing what the public already knows or believes is very important in designing effective outreach programs, as it will set the tone for new messages (Janoske et al. 2012); an audience that is angry and one that is worried will require different messages that address different issues (USHHS 2002). Understanding the audience is especially important when reaching out to populations with special circumstances,

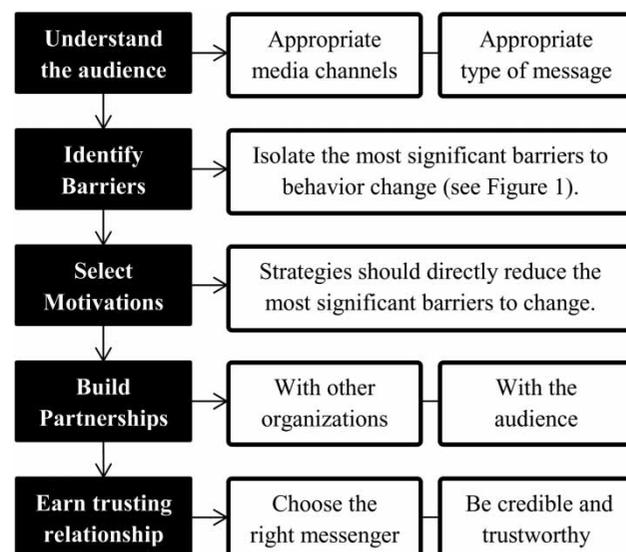


Figure 2 | Basic steps for creating an effective outreach program.

such as federally recognized tribes, religious communities, or other unique populations. These audiences can be difficult to reach and will often require a specific approach that is tailored to account for their customs, such as obtaining approval from community leaders (Janoske *et al.* 2012). Outreach programs should relate message content and recommended actions to local conditions to deliver relevant messages that resonate with well owners, as the most effective messages will be those developed with a particular audience in mind (Bier 2001; Wilson 2007; Kreps & Neuhauser 2010).

Additionally, identification of audience characteristics will inform communicators which media are most appropriate for distribution of messages. Different age groups prefer different media outlets, such as print-based media or the internet, and information that is released using multiple outlets representative of different demographic groups has a greater chance of reaching more people (Fitzgibbon *et al.* 2007; Fitzpatrick-Lewis *et al.* 2010). Distributing messages through channels that are familiar to the audience will greatly increase message acceptance, as people are typically more willing to accept messages that come from a trusted source (Jacob *et al.* 2010). When reaching out to rural well owners, it may be necessary to distribute information using specific channels that serve the rural areas where they live, such as small, local newspapers (Jones *et al.* 2005; Bettinger 2012). This will help ensure that the message is reaching its intended audience.

Methods of creating and disseminating messages

Upon gaining an understanding of audience characteristics, program coordinators can begin to consider more detailed factors that will be part of the communication process, such as specific types of messages. Tailored messages that are customized to each individual seem more relevant and are therefore more likely to lead to behavior change (Stellefson *et al.* 2008; Wanyonyi *et al.* 2011). These messages can be customized based on characteristics such as age or location and will greatly increase efficacy, especially when they account for the current behavior of an individual (Hurling *et al.* 2007; Snyder 2007; Kreps & Neuhauser 2010; Head *et al.* 2013). For private well outreach, tailoring can be achieved by giving each individual an opportunity to meet

with the educator one-on-one (Mancl *et al.* 1989). Although this can be time-intensive, it allows well owners to ask questions about their current practices and receive information that is relevant to their specific situation. Effective face-to-face communication allows well owners to clarify confusing points as needed to fully understand their situation and frequently results in increased adoption and maintenance of recommended behaviors (Fitzpatrick-Lewis *et al.* 2010; Wanyonyi *et al.* 2011).

Framed messages are a type of tailored communication that manipulate how information in a message is presented. Messages are most commonly framed in terms of positive outcomes associated with a behavior (gain-framed) or negative outcomes from non-compliance (loss-framed) (Fitzgibbon *et al.* 2007; O'Keefe & Jensen 2008; Stellefson *et al.* 2008; Myers 2010). To be most successful, this method of communication must be relevant to well owners by addressing their primary concerns. Private well testing recommendations that are accompanied by an explanation of the benefits of action and/or the consequences of inaction will typically be more impactful than a standalone recommendation (Cook & Berenberg 1981). For example, educators can reinforce testing recommendations by informing well owners of the contaminants that are common in their area and the effect they have on health, thus highlighting the potential consequences of drinking untested water. This is especially effective for well owners who have children, because children are more vulnerable to contaminants in water and more likely to become ill from drinking contaminated water (Postma *et al.* 2011).

The method of message dissemination is another factor of the communication process that can be customized based on audience characteristics. As discussed earlier, different segments of the population prefer different methods of communication, and outreach efforts should provide information through multiple channels to increase exposure (Fitzgibbon *et al.* 2007; Campo *et al.* 2013). Mass media and the Internet are common channels used for distributing messages, as they have a broad reach and a powerful influence on risk perception (Bennett & Glasgow 2009; Fitzpatrick-Lewis *et al.* 2010; Kreps & Neuhauser 2010; Wakefield *et al.* 2010; Korda & Itani 2013). However, because some well owners are not actively seeking information, educators should distribute information using more targeted approaches, such as direct mailings (Rich & Conn 1995; Renaud *et al.* 2011).

Using a direct approach to engage well owners will increase the reach of an educational program (Rosen *et al.* 2010), as information provided online will often go unnoticed by those who are unaware of the need for well testing and stewardship (Rich & Conn 1995). A multi-media approach that incorporates multiple channels of communication will increase the likelihood that the message will reach its intended audience, which will often lead to greater campaign success (Rich & Conn 1995; Fitzpatrick-Lewis *et al.* 2010).

Best practices for planning and conducting outreach campaigns

In advance of conducting an outreach campaign, there are several strategies that educators can consider to increase the overall strength and success of the campaign. Choosing the right messenger is important because the person delivering the message will affect how the message is accepted, and messages from a distrusted source can influence behavior negatively (Frewer 2004; Wilson 2007; Steelman & McCaffrey 2013). People tend to pay more attention to information from credible sources, so it is important to choose credible messengers and equally important that all sources present a consistent message (USHHS 2002; Fitzpatrick-Lewis *et al.* 2010). In situations where there is a high demand for information, for example during a localized water contamination event, it may be necessary to have more than one spokesperson available to ensure that the needs of the public are met (USHHS 2002; Schultz 2014). However, it remains important to clearly identify one person as the coordinator so that the public can develop a trusting relationship with him or her.

Building partnerships and collaborating with credible sources is an additional strategy that can increase the likelihood of campaign success (Castelnuovo 1999; McKinnon 2007). Partnerships that involve public health officials and respected community groups build trust within a community and will often make the audience more receptive to the message (Maslia *et al.* 2005; Balamurugan *et al.* 2007). This is especially true when approaching rural private well owners, as they will typically be more accepting of information and more likely to follow recommendations if they are familiar with and trust the source (Pyrch 1999). It is important that all partners involved in a campaign are completely aware of their goals and responsibilities as well as

providing a consistent message so that the public sees a well-organized effort (USHHS 2002; Maslia *et al.* 2005).

Beyond developing partnerships with other organizations, outreach coordinators should also accept and involve the public as partners. Interacting with participants allows educators to learn about their current opinions, attitudes, and behaviors, which will enable them to make the campaign more tailored to this specific audience (Bier 2001; McKinnon 2007). Involving the public early on will make them feel respected, especially if professionals work with them to correct misconceptions and reduce fears and concerns (USHHS 2002; Covello 2003; Maslia *et al.* 2005). Although this can be costly up front, it is effective in the long run if educators are successful at engaging as many members of the public as possible (Roche *et al.* 2013). For private well outreach, interaction with the audience in advance gives educators an idea of what their most significant concerns are. Educational offerings then can be customized to engage a specific group of well owners by providing relevant information that addresses their needs.

Educators who conduct outreach to private well owners must be capable of successfully engaging their audience and developing a trusting relationship with them. This requires educators to be sensitive to the needs of the audience and provide them with information that addresses their specific concerns in addition to the information that the educator wishes to communicate (Bier 2001; Frewer 2004). An educator's ability to connect with well owners will be enhanced if they are viewed as a credible and trustworthy source of information, which can be earned and maintained by being consistently truthful and frank with the audience (USHHS 2002; Janoske *et al.* 2012). Private well educational sessions should provide information that is concise, relevant to the local situation, and targeted to the audience's approximate level of comprehension so that well owners have a firm understanding of how to protect their well water (Covello 2003; Jacob *et al.* 2010).

IMPLICATIONS FOR PRIVATE WELL OUTREACH PROGRAMS

There are multiple motivations and barriers to behavior change as well as communication best practices that can be utilized to strengthen private well outreach campaigns.

Perhaps the most significant takeaway message from published studies is that there is no single approach to changing behavior that will be appropriate for every audience. For this reason, it is critically important for educators to develop an understanding of their audience in advance of conducting an outreach campaign. This will allow them to identify various factors that will influence the design of the campaign, including the audience's attitude towards private well testing and maintenance, their perception of the risk, and perhaps most importantly, their barriers to change. Identification of audience characteristics will enable educators to design outreach campaigns that are appropriately tailored to address specific audience concerns, making educational offerings more relevant and engaging. In addition to facilitating the development of appropriate outreach strategies, an understanding of the audience will allow educators to select communication techniques that will resonate with the audience.

Behavior change comes down to the effective development of educational programs that are successful at engaging the audience and persuading them that behavior change is both necessary and desirable. It is important to note that the most successful educational programs typically utilize other behavior change strategies in addition to providing information about the topic. There are many strategies that have the potential to change well owner attitudes, and a variety should be implemented to determine which will be most effective in different local areas where there are different concerns and barriers to change. The development of successful outreach programs will require different considerations with each audience, and educators must have a working knowledge of effective communication, as well as how to address barriers with the appropriate motivations in order to stimulate behavior change.

These key points, understanding the audience and utilizing multiple strategies, are especially important for addressing private well owners. Since well owners represent a diverse group of people, educators must be sure that the programs they offer are relevant to the specific audience in question and address the issues they are concerned about. Increasing well owner participation in outreach programs will require educators to conduct groundwork within target communities and rural areas so they are able to

identify the factors that will truly engage this group of well owners. Programs that have been engaged in an area for an extended period of time will be both familiar with their characteristics and more trusted by the target audience, which will improve the likelihood that individuals will attend educational sessions and follow recommendations. New outreach programs that are unfamiliar with their audience should seek to partner with organizations or other programs that have a presence in the community so they are able to tap into the existing knowledge about the audience. In short, the secret to success for any given outreach program lies in the coordinators' ability to use all of the tools at their disposal to tailor their program to each audience they address. This will begin with broad steps, such as building partnerships and learning about the audience, and will transition into smaller, more detailed decisions, such as selecting the specific motivations that will overcome the most significant barriers to change.

IT DOES NOT END HERE

This paper outlines a process that will help outreach educators engage well owners and motivate them to become active in well stewardship and well water testing. The initial goal is to increase well owner understanding of their responsibilities to themselves, their families, and others to protect their health. But then what? Outreach programs must strive to provide well owners with the continual support and assistance they need to become informed stewards of their water supply. Addressing significant barriers with targeted motivational strategies can successfully engage well owners, but educators must acknowledge the fact that long-term behavior change rarely happens in the course of a single workshop or sampling event (Clements 1999). Well owners who follow the advice of outreach educators and test their water often face additional challenges, including difficult-to-interpret test results, uncertainty about how to respond when test results indicate a problem, and potentially expensive treatment options (Pyrch 1999; Chappells *et al.* 2015; Flanagan *et al.* 2015a). This indicates a need for continued contact from educators, so that well owners have a familiar, reliable resource to consult when they need help. Maintaining a presence among well owners

after a testing program is complete will provide them with the encouragement and support they need to fully adopting stewardship behaviors (Frahm et al. 1996; Clements 1999).

ACKNOWLEDGEMENTS

This research was funded by the United States Centers for Disease Control and Prevention (CDC). This paper is part of the deliverables for contract # 200-2013-57301 0004 – Identification, Evaluation, and Testing of Effective Educational Campaigns for Private Well Owners, Angela Salazar, Project Officer. Thank you to Cassia Smith, Illinois State Water Survey, who assisted in identifying potential resource materials for this paper.

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First received 1 April 2015; accepted in revised form 25 September 2015. Available online 10 October 2015