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Article

A Case Study: The Development of Safety Tip Sheets for ATV Use in Ranching

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Abstract: Use of all-terrain vehicles (ATVs) has become standard practice on the modern ranch. The unique operating conditions present on a ranch, subject the occupational ATV user to hazards requiring awareness and specialized training. The purpose of this study was to apply social marketing methods to address a specific environmental health and safety issue present in the agricultural industry. A series of four ATV tip sheets were created in topic areas specific to the challenges that ATV operators encounter on a ranch. In order to evaluate the intended audiences' perception of the tip sheets, a questionnaire was administered to all agriculture operators and producers throughout McCone County, Montana, USA. Questionnaire responses indicated that the tip sheets contained quality information and were relevant to the occupational hazards present when using ATVs for agricultural purposes. Future work should focus on the dissemination of this information and continued emphasis on industry specific training for ATV operators.

Keywords: ATV; All-Terrain-Vehicle; agriculture; ranching; occupational injury

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1. Introduction

Workers in the agricultural industry face many unique hazards and exposures including operating heavy machinery, working with live animals, and adverse environmental conditions. As a result, agriculture workers in the United States are consistently ranked as having one of the highest occupational injury and fatality rates [1]. All-terrain vehicles (ATVs) have become an indispensable tool in ranching, often replacing the horse and pick-up truck as the primary ranch or farm vehicle [2] to check stock, for personal transportation and for the transport of materials over rough terrain not as easily accessible by other vehicles [3]. Other uses specific to the agricultural industry include: herding cattle, personal transportation around ranch and farm land, and pesticide application using spray tanks [4]. According to the Consumer Product Safety Commission (CPSC), an ATV is "an off-road, motorized vehicle having three or four low-pressure tires, a straddle seat for the operator, and handlebars for steering control" [5]. ATVs vary by definition, and are studied separately, in comparison to recreational off-highway vehicles (ROVs) and utility terrain vehicles (UTVs), due to these vehicles having steering wheels, bucket seats, and safety equipment such as roll-over protection and seatbelts.

The U.S. Consumer Product Safety Commission estimates 10.7 million ATVs were in use in 2011 and documented 684 deaths associated with ATVs during that year [5]. While a majority of documented ATV-related injuries take place during recreational use, these injury and fatality statistics may be applied to occupational settings in order to identify trends and develop prevention strategies and interventions [6]. Between 1992 and 2007 the number of work-related deaths involving ATVs increased nearly 275% and the fatality rate per 1,000,000 workers increased 300% [7]. During the same period, the CPSC estimates the number of ATVs in use increasing from 1.9 million to 10.7 million [5]. ATV injuries in agriculture are not exclusively a problem in the United States; studies from Australia and New Zealand have also identified the ATV as a predominant cause of injury in their agriculture industries [4].

ATV users in an agricultural stetting operate under a different set of psychological and environmental conditions than the recreational rider [8]. In many cases, the different environmental conditions and intended uses expose the occupational rider to a higher risk of injury and death. Occupational riders must operate under adverse weather conditions, dangerous and changing terrain and may encounter dynamic situations (such as charging cattle) leading to loss of control, injury or fatality. Aftermarket modifications to the ATV may alter the vehicle's performance and safety by changing center of balance, load distribution, maneuverability, and safe handling and increase the likelihood of overturn, especially if the user is carrying a shifting load such as a spray tank filled with fluid [6,8].

Effective strategies are urgently needed to enhance occupational ATV safety awareness especially in agriculture. Between 2003 and 2006, 65% of all ATV occupational fatalities occurred in the agriculture industry [9]. The authors hypothesize that tailoring safety messages to a specific population's use of ATVs would decrease ATV related injuries and deaths in the targeted population.

Social marketing is a technique used to motivate and support behavior change [10]. The goal of a successful social marketing campaign is to influence change in a specific audience. There are four main components of social marketing theory: product, price, promotion, and place [11]. Each stage of the process plays an important role in the success and adoption of the desired change. The product component of social marketing refers to the concept, objects or behavior that is advocated by the campaign. Price is the cost of the change to individuals and society and considers all barriers to the

adoption of the desired change. The price includes not only the financial cost, but also costs to productivity as well as the cultural, emotional and/or physical costs. The third component, promotion, is the medium in which the message is spread or disseminated throughout the target audience. Finally, place is the physical or social environment where the promotion will be received as well as the environment where the desired change will occur [11].

Applying social marking to the development of safety campaigns can be accomplished using a participatory approach by including the intended audience throughout the formative and final summative evaluation process. Brann, Mullins, Miller, Graham, & Aitken (2012) report that by including ATV users from local ranches in the design of safety messages, clarity, more realistic examples, and user-friendly layouts can be developed. Safety messages are often used to emphasize previous comprehensive, hands-on training [12,13] and provide quick reminders to those performing high risk tasks.

Effective safety messages must first be recognized, the information understood, and then acted upon [13]. Research indicates that posted safety messages have a lower compliance rating then written in-task instructions, but could ultimately be beneficial when utilized as occasional reminders for the experienced worker [14]. Effective safety messages should be selective and provide focused messages [15], give positive instruction to reinforce existing attitudes or knowledge regarding safety [13], and always be used in conjunction with more in-depth training programs. One goal of our project was to increase awareness of the resources available in the United States by promoting the ATV Safety Training offered by the ATV Safety Institute (ASI).

The purpose of this case study was to apply social marketing methods to address a specific need in the agricultural community around safe ATV use for specific ranching tasks while increasing future participation in the ASI hands-on Ridercourse training.

2. Methods

2.1. Experimental Design

To create a safety campaign specific to the ranching community, a series of four focus group sessions were conducted in Montana, USA. Sessions comprised 5–7 volunteers, aged 16–80, who were either agriculture producers or agriculture extension agents for their county. Focus groups sessions were approximately three hours in duration and participants were compensated for their time. The goal of the first three focus groups was to generate and refine subject matter and key points for campaign messages while including the four social marketing principles throughout the formative evaluation process. The final focus group reviewed the finalized campaign messaging for production and dissemination. The outcome of the focus groups were four "tip sheets" with pertinent safety information, advice, and culturally relevant pictures of appropriate use of ATVs in ranching.

The focus groups were asked a series of open-ended discussion questions on their use of ATV, perceptions about the current availability of training, any safety concerns they currently have about using ATVs, ideas on how safety messages should be distributed *etc.* Based on the general theme of the responses to these questions, which included the need for task specific training on the tasks which require the most skill and/or risk and the need to be familiar with the capabilities of your equipment, the focus groups generated the following topic areas for the tip sheets: general use, animal handling, fence building

and maintenance, weed control and spray operations. Based on the recommendations of the focus groups, the final ATV tip sheet topics were: General ATV Safety (which included information on age limitations, maintenance, personal protective equipment (PPE), and active riding techniques) (Figure S1), animal handling (Figure S2), fencing (Figure S3), and spraying with ATVs (Figure S4). Each tip sheet was presented in a poster format with the carefully crafted text, key points in bulleted form and pictures relevant to the task and agricultural industry.

2.2. Data Collection

To quantitatively evaluate perceptions of the ranching-specific ATV tip sheets a questionnaire was developed to assess reaction, perceptions and impact. The questionnaire included 13 questions and was distributed by mail along with a copy of each tip sheet for reference to all agriculture operations and producers in McCone County, Montana, USA. The questionnaire was distributed to 220 addresses of known agricultural producers by a list provided by a McCone County Agricultural Extension Agent. According to statistics from the USDA Census (2012), there are 241 full owners of farms/ranches in McCone County [16]. McCone County is similar to the whole of Montana in that both place an emphasis on livestock over crop production. Average ranch size in McCone County is larger than the Montana average at 2806 and 2134 acres respectively [16]. IRB approval was obtained through Colorado State University.

The questionnaire was designed to evaluate the perceived applicability, usefulness, and relevance of the information presented in the tip sheets. Demographics were gathered from questionnaire responses in regard to both respondent age and gender as well as characteristics about their ranching operations such as ranch size and number of ATVs used on the ranch.

The questionnaire asked the following key questions relating to the tip sheets:

1. Did you read the ATV Tip Sheet material?
2. Please rate how relevant the tip sheet material was to your farming and/or ranching activities on a scale of 1–10, 1 representing “not relevant” and 10 representing “extremely relevant”.
3. Did any specific information on the tip sheet give you information that you did not already know? If so, please describe the information that was new to you.
4. Did the tip sheet information cause you to think about your and/or your workers’ safety and how you perform the activities mention using the ATVs?
5. Do you believe that you will change the way that you operate ATVs on your farm or ranch in the future as a result of the information presented on the tip sheet? Why/Why not?
6. Did you share the tip sheet with others? If so, who?
7. In your opinion is the tip sheet high quality safety and health information?
8. Are there other ATV tasks that should have tip sheets developed to help farmers and ranchers be safe? If so, what tasks?

Questions such as: did the tip sheets contain quality information; did you share the tip sheets with anyone else, *etc.* were answered through yes/no responses. The relevance of the tip sheets was measured through use of a 10-point Likert Scale with 1 being “not relevant” and 10 being “extremely relevant”.

2.3. Data Analysis

Responses were analyzed using Statistical Analysis System (SAS) version 9.4 (SAS Institute Inc, Cary, NC, USA). Measures of central tendency were calculated for continuous responses and frequency statistics were calculated for categorical variables. Likert Scale data were treated as ordinal data during analysis. A Spearman Correlation was used to associate the continuous demographic variables to the relevance of the tip sheets. A Wilcoxon-Mann-Whitney test was used to compare categorical demographic responses and yes/no questionnaire responses to the relevance of the tip sheets. Both the Spearman Correlation and the Wilcoxon-Mann-Whitney test were used due to the assumption of normality not being met by the Likert Scale responses to the relevance of the tip sheets.

3. Results

Sixty-four questionnaire responses of the 220 distributed were retuned by mail resulting in a 29% response rate. Participants were between the ages of 34–81, mean age of 58.7. Seventy-six percent of participants who responded to the questionnaire were male. Participants were asked to report the size of ranch they worked on and how many ATVs were used on the ranch. Mean ranch size was 433 acres and mean number of ATVs used on the ranch was two.

Responses to yes/no questions can be found in Table 1. Likert responses to the relevance of the tip sheets are shown in Figure 1, with 71.9% of all respondents associating the ATV Tip Sheet's relevance with a score of 7 or greater.

Table 1. Questionnaire Responses.

Question	Yes	No
Did you read the ATV Tip Sheet material?	62 (97%)	2 (3%)
Did any specific information on the tip sheet give you information that you did not already know?	10 (36%)	53 (64%)
Did the tip sheet information cause you to think about your and/or your workers' safety and how you perform the activities mentioned using ATVs?	47 (78%)	13 (22%)
Do you believe that you will change the way that you operate ATVs on your ranch in the future as a result of the information presented on the tip sheet?	11 (23%)	37 (77%)
Did you share the tip sheet with others?	25 (49%)	26 (51%)
In your opinion, is the Tip Sheet high quality safety and health information?	56 (93%)	4 (7%)

A Spearman Correlation was calculated to determine a relationship between continuous demographic responses of age, number of ATVs owned, and ranch size to the response to the relevance score between 1 and 10 of the tip sheets. No significant correlations were found between continuous variables and the Likert response to relevance (Table 2).

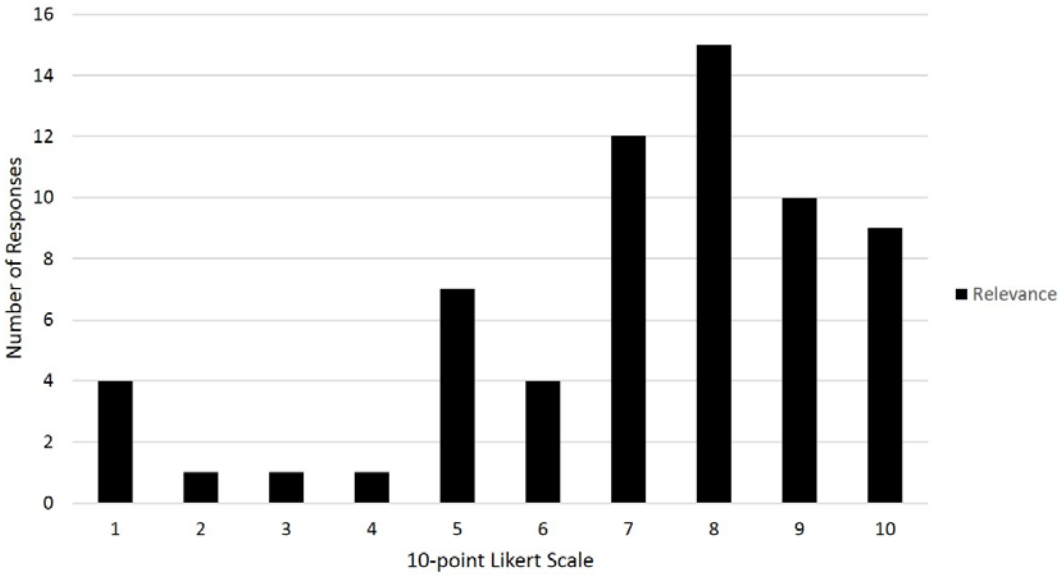

Figure 1. Responses to Tip Sheet Relevance. Please rate how relevant the tip sheet material was to your ranching activities, on a scale of 1–10, 1 representing "not relevant" and 10 representing "extremely relevant".

Table 2. Spearman Correlation Data.

Cotinuous Response Variable	N	Spearman Correlation Coefficients	Prob > |r|
Age	55	−0.010	0.944
Number of ATV's Owned	53	0.211	0.129
Ranch Size	44	0.101	0.513

A Wilcoxon-Mann-Whitney statistic was calculated in order to determine the relationship between the following categorical responses and the response to the relevance of the tip sheets (Table 3).

- Gender;
- Do you believe that you will change the way that you operate ATVs on your farm or ranch in the future as a result of the information presented on the tip sheet?
- Did the tip sheet information cause you to think about your and/or your workers' safety?
- Did any specific information on the tip sheet give you information that you did not already know?

Statistical significance (p <0.05) was found between gender and the response to relevance (p = 0.027), as well as the binary response of if the tip sheet provided caused the respondent to think about safety and the response to relevance (p = 0.002).

Table 3. Wilcoxon-Mann-Whitney Data.

Categorical Response Variable	N	Wilcoxon Statistic	*p*-Value
Gender (Male/Female)	(13/41)	466.0	0.027 *
Do you believe that you will change the way that you operate ATVs? (Yes/No)	(11/37)	317.0	0.241
Did the tip sheet information cause you to think about your and/or your workers' safety?(Yes/No)	(47/13)	225.5	0.002 *
Did any specific information on the tip sheet give you information that you did not already know? (Yes/No)	(10/53)	420.5	0.056

Note: * Denotes Statistical Significance $p < 0.05$.

Comments and short answer responses to questions were compiled and coded for similarities. Respondents gave feedback on which pieces information were new to them, reasons why or why not they will change their operation of ATV's in the future, who they shared the tip sheets with, and if there were any other topics that should be covered in the tip sheets. Questionnaire respondents reported learning new information on use of spray tanks with baffles, as well as information pertaining to active riding on hills or other rough terrain and information specific to animal handling tasks. Cited reasons why participants will change their behavior while using ATVs included: a friend lost his life on an ATV, the importance of safety, and requirements regulating the use of helmets. Reasons reported for participants not changing their behavior were: they currently operate in a safe manner, lack of appropriate equipment, or time constraints.

4. Discussion

There exists a lack of strategies proven to convey and reinforce safe behaviors and practices regarding ATV safety in agriculture [3]. The purpose of this case study was to apply social marketing methods to address the urgent need for well designed, culturally relevant messages about safe ATV use on ranches and increase participation in ASI training to save lives and reduce injuries among this high risk group. By inclusion of the intended audience in the creation of a campaign, and ensuring the four social marketing principles had been addressed, we achieved formative and summative evaluation of an agriculture specific safety campaign which a very high majority (93%) of questionnaire respondents believed contained quality information.

The principles of social marketing [11] were addressed in the creation of the ATV tip sheets during the four focus groups that occurred. To ensure that the safety messages were effectively communicated and applicable to ranching, the focus groups were comprised of entirely agricultural producers or Agriculture Extension Agents that brainstormed and narrowed the focus of each safety tip sheets to include only the most preferred text, relevant photos, attractive and logical layout, and critical topics crucial to safe ATV operation. The second social marketing principle, price, was addressed at a separate focus group when the question was raised what the group believed that barriers to adoption of safe use practices and additional hands-on training existed. Suggestions were made to create insurance incentives and discounts for ATV training and safe use. Agricultural producers wanted easily accessible hands-on training in the community and did not wish to drive long distances and suffer lost work time, negative productivity impacts, increased fuel costs and wear and tear on their trucks and trailers. Finally,

promotion and place were discussed jointly, as the medium of the safety message would depend on the environment of dissemination.

There were a number of dissemination suggestions that were presented both during the focus groups as well as in questionnaire responses. Nearly half of questionnaire respondents shared the information with other people, suggesting that supplying handouts to interested people may be an effective means of disseminating information. The high percentage of questionnaire responses indicating the tip sheets made them think about safety during ATV operation suggests that the tips sheets may be effective if hung in public, highly-viewed areas such as at the local bank, shopping centers and during country fairs. The research of Snell (1977) and Brann, Mullins, Miller, Graham, and Aitken (2012) both suggested that printed messages may be most effective when used as a reminder of more in-depth training that occurred at an earlier date[12,13]. For this reason, a continued emphasis on hands-on training sessions, such as those offered thorough the ATV Safety Institute (ASI), should be accentuated. Specifically, there may be increased effectiveness of the tip sheets (and hands-on training) if they are presented in conjunction with an ATV safety course which introduces the riders to the specific challenges encountered by using ATVs in an occupational setting.

Due to formative techniques used in the development of the tip sheets, as well as the positive feedback and responses from the questionnaire data, there should be a new focus on community engagement to ensure the effectiveness of messages and use of all dissemination channels.

This case study is subject to three main limitations. First, the survey was administered in one county of Montana, USA. McCone County may not represent the typical rancher throughout the state and across the country, or across the world. McCone County has a population of 1694 with an average of 0.7 people per square mile, making it more rural than all of Montana and the USA with an average of 6.8 and 87.4 people per square mile respectively [17]. In addition, the average ranch size in McCone County is larger than the Montana average. However, the emphasis on livestock production over crop production in McCone County does mirror that of the state of Montana [17]. The McCone County population was chosen as a sample of convenience for this case study due to the relationships established with the community and the agriculture extension agent for the area. Second, while the questionnaire response rate was nearly 30% and inferences can be made, the sample size of the study was still small and thus limits the ability to externalize to other ranching populations. Lastly, the study may be subject to sampling bias in that participants with an interest in the safety of ATVs, or who participated in the original focus groups, may have been more likely to complete the questionnaire and provide favorable responses. This bias would support the purpose of our case study and lead us to believe our methods were more effective than they actually were.

More research should be completed to determine if this safety campaign would be received similarly in other parts of the state and/or country.

5. Conclusions

This study demonstrated the use of social marketing principles to develop, produce and disseminate a targeted safety message about ATV safe use on ranches in Montana. Dissemination of the agriculture specific safety messages should continue in accordance with the suggestions of agriculture operators and other community partners. While this case study was not able to measure long-term impact, the messages

were received favorably and suggest that agricultural operators are influenced by safety messages and open to additional safety intervention in the form of hands-on training. The questionnaire was able to gauge the local ranching community's perception of the safety campaign and supports the need for additional campaigns. Further evaluation of the efficacy of ATV-related safety messages in the agricultural industry is required to fully assess their impact on ATV users' knowledge and behavior, and long-term impact through reduction of injury and fatality.

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Conflicts of Interest

The authors declare no conflict of interest.

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