Social Marketing for Injury Prevention
Changing risk perceptions and safety-related behaviors among New York farmers

Julie Sorensen

Umeå 2009
“If we cannot develop a US model for a proven intervention on the single most important cause of agricultural mortality - tractor overturns - how can we succeed in addressing the less dramatic yet still important causes of agricultural diseases and injuries?”

Dr. James Merchant  
Dean, College of Public Health, University of Iowa  
Addressing the Surgeon-General’s Conference on Agricultural Safety and Health  
April 30-May 3, 1991
Abstract

In the U.S., work-related death is an all too familiar occurrence on farms. Tractor overturns continue to be the most frequent cause of these fatalities. Efforts to alter farming’s ranking as one of the most deadly occupations in the country must provide proven strategies for the elimination of these preventable deaths.

In the past, efforts to decrease the rate of overturn fatalities and injuries have largely focused on increasing the proportion of tractors with a rollover protective structure (ROPS). These devices, in combination with seatbelts, are 99% effective in protecting the tractor operator from death or injury. Unfortunately, only 59% of U.S. tractors are currently equipped with ROPS. Due to the relative lack of political willpower to legislate ROPS installation and the less than encouraging response to education and awareness programs to date, it appeared necessary to explore alternative intervention strategies.

The over-arching purpose of this thesis project has been to assess the utility of social marketing as a framework for developing effective health and safety interventions in the farm community. However, our specific objectives included; a more thorough understanding of the perceived barriers and motivators that influence farmer’s safety decisions, the design and evaluation of social marketing incentives developed to encourage safe behaviors and the evaluation of a social marketing campaign designed to positively impact farmer’s intentions and readiness to retrofit unsafe tractors.

The research was by and large conducted in New York State and supported by grants from the National Institutes of Occupational Safety and Health (NIOSH). Previous research conducted in the New York farm community had indicated that small crop and livestock farmers would be an ideal intervention target for a social marketing tractor overturn intervention as their farms accounted for close to 85% of New York farms which lack or have only one ROPS protected tractor.

A qualitative assessment of perceived barriers and motivators regarding retrofitting behaviors was performed with representatives of the small crop and livestock community. Grounded theory analysis of these in-depth interviews revealed several key categories which include: 1) risk becomes “normal”, 2) risk becomes part of a “farming identity”, and 3) risk becomes “cost-effective”. This information was used to design potential intervention incentives, such as toll-free assistance finding and purchasing ROPS, financial rebates, and campaign messages designed to address farmer’s stated concerns. Subsequent research included testing and revising messages and evaluating the effect of the different campaign incentives in a prospective, quasi-randomized, controlled trial conducted in different regions of New York and Pennsylvania.

The results indicate that social marketing offers a promising framework for the development of injury or fatality prevention programs in farm communities. Farmers in the social marketing region demonstrated the most significant changes in both behavioral intention and readiness to retrofit compared to farmers from other regions. Data also indicated that social norms strongly influence farmer’s decisions to work safely, as demonstrated by the strong correlations between behavioral intention measures and measures of social norms.
As well as providing an assessment of the utility of social marketing as an intervention framework, the thesis provides a cogent example of how behavioral theories can be used in the design and evaluation of intervention programs. Both stages of change theory and the theory of planned behavior proved to be valuable for measuring dispositional and behavioral changes and for fine-tuning future interventions.

**Keywords:** Social marketing, Behavior models, Roll-over protective structures, Tractor overturns, Farm safety, Occupational health, Safety intervention, Retrofitting incentives, Health campaigns, Intervention evaluation
Glossary

This glossary is mainly derived from:
Basic and Clinical Biostatistics (Dawson and Trapp, 2004).
Health Behavior and Health Education (Glanz, Rimer and Lewis, 2002).
Qualitative Methodology for International Public Health (Dahlgren et al, 2004).
USDA website (U S Department of Agriculture, 2008).

Analysis of variance (ANOVA)  A statistical analysis which involves comparing the means of a continuous variable between more than two treatment levels. One-way ANOVA is used if means are compared across levels of a single explanatory variable. Analyses involving levels of multiple explanatory variables, and their interaction, requires the use of two-way ANOVA.

Behavioral precedents  Factors that are influential in an individual's decision to engage in a particular behavior. According to the theory of planned behavior, the factors that are most likely to affect an individual's behavior are attitudes related to performing the behavior, social norms surrounding the behavior and the individual's perceived ability to engage in the behavior. These variables can be measured both directly and indirectly.

Cab  A structure found on some tractors which provides a seated enclosure for the tractor driver. This enclosure can protect the driver from the weather or pesticides. Rollover protective structures are built into the interior of most tractor cabs.

Category  A collection of codes that are linked in some meaningful way and which collectively create a more abstract, overarching, descriptive summary statement that stems from qualitative data.

Codes  Words or phrases which capture or summarize important information found in qualitative data transcripts.

Concept development  Is the process of creating a cohesive framework around which advertisements, messages and promotional efforts are organized in social marketing campaigns.

Cooperative Extension  A national network of education and research offices in the U S that are based at land-grant universities. Extension offices serve agricultural producers, small-business owners, youth and other groups who live and work in rural areas.

Farm Bureau  A national organization which interacts with agricultural groups at the state and county level to support political initiatives which benefit and strengthen farm communities.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus groups</strong></td>
<td>A method of collecting qualitative data through focused group discussions. The method takes advantage of the group interaction and is ideal for exploring attitudes and norm systems related to a particular phenomenon.</td>
</tr>
<tr>
<td><strong>Formative research</strong></td>
<td>Research which is gathered in the initial study phase to provide a thorough understanding of a particular phenomenon and which is later used to inform the design of health interventions.</td>
</tr>
<tr>
<td><strong>Grounded Theory</strong></td>
<td>A method of qualitative analysis based on conceptualizing of empirical data. Aims at theory development and analytical generalizability grounded in informants’ experiences.</td>
</tr>
<tr>
<td><strong>Hotline</strong></td>
<td>A toll-free phone number provided through the New York ROPS Rebate Program which offered free assistance to farmers seeking to retrofit unprotected tractors.</td>
</tr>
<tr>
<td><strong>In-depth interviews</strong></td>
<td>A means for collecting qualitative data by conducting informal, open-ended and detailed discussions with individual informants.</td>
</tr>
<tr>
<td><strong>Linear regression</strong></td>
<td>A statistical analysis used to estimate the equation that best predicts the relationship between a continuous dependent variable and one or more predictor variables.</td>
</tr>
<tr>
<td><strong>Motivators</strong></td>
<td>Advantages related to changing behaviors that are identified by the target population.</td>
</tr>
<tr>
<td><strong>Optimistic bias</strong></td>
<td>An individual’s perception that they are not vulnerable or that they are less vulnerable than others to negative outcomes related to a particular risk exposure.</td>
</tr>
<tr>
<td><strong>Principal operator</strong></td>
<td>The individual who is principally responsible for running the farm and making daily farm management decisions.</td>
</tr>
<tr>
<td><strong>Purposive sampling</strong></td>
<td>A strategic method of selecting informants for a qualitative study based on their particular backgrounds or experiences.</td>
</tr>
<tr>
<td><strong>Random sample</strong></td>
<td>A method of sampling in which every member of the population has an equal probability of being selected.</td>
</tr>
<tr>
<td><strong>Retrofit</strong></td>
<td>The installation of roll-over protective structures on tractors which are not originally equipped with these safety devices.</td>
</tr>
<tr>
<td><strong>Saturation</strong></td>
<td>The stage in qualitative data collection where new themes or ideas have ceased to emerge.</td>
</tr>
<tr>
<td><strong>Semi-structured guide</strong></td>
<td>An interview guide which contains subject themes, question topics and probes that are not necessarily followed in any certain order. A semi-structured guide helps researchers insure that certain topics are covered, while still allowing informants to emphasize what is important or discuss topics in an unstructured, organic way.</td>
</tr>
<tr>
<td><strong>Social marketing theory</strong></td>
<td>Social marketing is an intervention development framework which is based on the concept of exchange. This framework demands that researchers work to increase the benefits of healthy behaviors and decrease the costs so that healthy behaviors are a more appealing option.</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Stage of change theory</strong></td>
<td>A behavioral theory which posits that individuals attempting to change a particular behavior travel through a number of stages before actual behavior change occurs. Research indicates these stages are fairly uniform regardless of the behavior or the population involved.</td>
</tr>
<tr>
<td><strong>Target audience</strong></td>
<td>The segment of a population which has been selected as the focus for a particular intervention.</td>
</tr>
<tr>
<td><strong>Themes</strong></td>
<td>Over-arching topics or subject areas that run throughout qualitative data collection and which capture information significant to the research topic.</td>
</tr>
<tr>
<td><strong>Theory of planned behavior</strong></td>
<td>A behavior change theory which attempts to measure the relationship between factors most likely to influence an individual's intention to change, as well as the relationship between intention to change and behavior change. Factors that are considered to influence an individual's intention to change are attitudes, social norms and perceived behavioral control.</td>
</tr>
<tr>
<td><strong>Triads</strong></td>
<td>Smaller group discussions attended by 3-5 participants.</td>
</tr>
</tbody>
</table>
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
</tr>
<tr>
<td>ASAE</td>
<td>American Society of Agricultural Engineers</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>FACE</td>
<td>Fatality Assessment and Control Evaluation</td>
</tr>
<tr>
<td>NASS</td>
<td>National Agricultural Statistics Service</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institutes of Occupational Safety and Health</td>
</tr>
<tr>
<td>NYCAMH</td>
<td>New York Center for Agricultural Medicine and Health</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>ROPS</td>
<td>Rollover Protective Structures</td>
</tr>
<tr>
<td>TSI</td>
<td>Tractor Safety Initiative</td>
</tr>
</tbody>
</table>
Original Papers

This thesis is based on the following papers:


Permission for the reprinting of papers has been granted by the following publishers:

Paper I: The American Society of Agricultural and Biological Engineers
Paper II: Sage Publications, Inc.
Paper III: Taylor and Francis, Inc.
## Contents

Abstract .......................................................................................................................................................................................................................... i  
Glossary .......................................................................................................................................................................................................................... iii  
Abbreviations ............................................................................................................................................................................................................... vi  
Original Papers .................................................................................................................................................................................................. vii  
Introduction ........................................................................................................................................................................................................... 1  
Background ........................................................................................................................................................................................................... 3  
  Rollover protective structures ............................................................................................................................................................ 3  
  Educational interventions ....................................................................................................................................................................... 5  
  Legislation ................................................................................................................................................................................................................ 5  
Study Context ...................................................................................................................................................................................................... 7  
  US initiatives to reduce tractor overturn fatalities and injuries .................................................................................................................. 7  
  New York ROPS Social Marketing Initiative ......................................................................................................................................... 7  
  Study area ........................................................................................................................................................................................................... 8  
  Initial project research ........................................................................................................................................................................ 9  
  The starting point for this thesis ........................................................................................................................................................... 10  
Objectives ................................................................................................................................................................................................................ 11  
  Overall objectives .................................................................................................................................................................................. 11  
  Specific objectives .................................................................................................................................................................................. 11  
Theoretical Framework ............................................................................................................................................................................. 12  
  Social marketing .................................................................................................................................................................................. 12  
  Stages of change theory .................................................................................................................................................................... 13  
  Theory of planned behavior ............................................................................................................................................................... 15  
Materials And Methods ........................................................................................................................................................................... 17  
  Combining multiple methods for multiple purposes .................................................................................................................................. 17  
  Barriers and motivators influencing farmer’s safety decisions (Paper I) .......................................................................................... 21  
  Design and evaluation of social marketing incentives (Papers II and III) ........................................................................................ 23  
  Evaluation of a social marketing campaign (Papers III, IV, Economic analysis and Hotline data) ................................................ 25
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Findings</td>
<td>31</td>
</tr>
<tr>
<td>Barriers and motivators influencing farmer’s safety decisions (Paper I)</td>
<td>31</td>
</tr>
<tr>
<td>The design and evaluation of social marketing incentives (Papers II and III)</td>
<td>34</td>
</tr>
<tr>
<td>Evaluation of a social marketing campaign</td>
<td>36</td>
</tr>
<tr>
<td>(Papers III, IV, Economic analysis and Hotline data)</td>
<td></td>
</tr>
<tr>
<td>Methodological Considerations</td>
<td>40</td>
</tr>
<tr>
<td>Discussion</td>
<td>43</td>
</tr>
<tr>
<td>Conclusions and Recommendations</td>
<td>50</td>
</tr>
<tr>
<td>The Researcher</td>
<td>52</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>54</td>
</tr>
<tr>
<td>References</td>
<td>56</td>
</tr>
<tr>
<td>Appendices</td>
<td>63</td>
</tr>
</tbody>
</table>
Introduction

Agriculture is currently the deadliest occupation in the U.S. (National Safety Council, 2008). Compared to the average occupational fatality rate, the rate of farm fatalities is roughly eight times greater (U.S. Bureau of Labor Statistics, 2008) making safety interventions in farm communities an occupational health priority (NIOSH, Preventing Death and Injury in Tractor Overturns with Roll-Over Protective Structures). Although there are myriad hazard exposures on farms (Papers and Proceedings of the Surgeon General's Conference on Agricultural Safety and Health, 1991; Lundqvist, 2000; Donham and Thelin, 2006), the most frequent contributor to farm fatality rates is the farm tractor (Myers, 1998; Myers et al., 1998; Murphy, 2006; Murphy and Kassab, 2006). Since the introduction of these machines onto U.S. farms in the early part of the 20th century, they have contributed greatly to the productivity, but also to the dangers of farming.

As health administrators and public health researchers understand clearly, reducing the unacceptably high rates of farm fatalities demands a considered focus on making tractor operation safer (NIOSH, Preventing Death and Injury in Tractor Overturns with Roll-Over Protective Structures, NIOSH Center Directors, 2004). To do this requires measures which improve survival rates for the most frequent and arguably the most preventable, cause of tractor-related deaths, the tractor overturn (Myers, 2002; Ayers and Liu, 2003; NIOSH Center Directors, 2004).

The research discussed in this thesis is largely devoted to the issue of tractor overturns and the investigation, design and piloting of an intervention aimed at reducing overturn fatality rates in New York State. However, the research is likely to have broader implications, as well. Most notably, it provides an example of alternative intervention strategies that can be applied to health behaviors resistant to change. As will be made clear in the coming chapters, changing health and safety behaviors in farm populations can be a complicated and challenging enterprise. It requires addressing numerous influences, both economic and societal, which currently work in concert to make risk taking a more desirable option than working safely (Elkind, 1993; Green, 1999). These behavioral barriers, however, are in no way unique to farm populations. A review of the risk prevention literature provides ample support for the conclusion that many intransigent public health and safety issues ranging from intimate partner violence to adolescent hearing damage are fueled by similar environmental, social and economic influences (Brown, 2005; Field et al, 2008; Gupta et al, 2008; Vogel et al, 2008). Overcoming these barriers will quite likely involve an in-depth, population-oriented understanding of health issues and the design of interventions which compete effectively with unhealthy behaviors. The “customer-centered” emphasis of social marketing research holds considerable promise for the research community in this respect.

As well as providing an example of how social marketing principles can be applied to develop responsive health behavior solutions, the thesis provides an illustration of how both quantitative and qualitative methods can be utilized together to provide an in-depth, individualized understanding of health issues, as well as quantifiable, population-based measures of health behaviors. Concluding remarks explore the potential limitations, implications and considerations related to the thesis research and how these considerations might impact similar public health interventions or research.
On a more personal note, much has been learned in the four years of research devoted to this thesis project. To be honest, both my project advisor and I had little confidence that this project could successfully encourage safety behaviors which required such a considerable financial investment to resolve a safety issue that our target audience was relatively unmotivated to address. I am happy to say that despite our lack of confidence, we have learned that by considering the issue from a farmer’s perspective and by providing solutions that address a farmer’s needs much can been gained.
Background

Tractor overturns are the most frequent cause of tractor-related death in the U.S. (Myers et al., 1998; Mason and Earle-Richardson, 2002; NIOSH Center Directors, 2004; Murphy, 2006; Murphy and Kassab, 2006). These events occur when the tractor a farmer is operating tips either sideways or over backwards, essentially crushing the operator under the weight of the tractor.

In the early 1950s tractors became a more frequent fixture on American farms. Looking back to this period, in only one year 490 to 680 deaths were attributed to tractor overturns (Job, 2008). Despite significant improvements in tractor safety design since the early 50’s, and a concomitant decline in farm operators, there are still approximately 130 deaths annually attributable to overturns (NIOSH Center Directors, 2004). These events contribute to a sizeable proportion of agricultural deaths (15%) and with their elimination could have significant impact on agricultural fatality rates (Myers et al, 1998; NIOSH Center Directors, 2004).

Fatality statistics, however, provide only part of the picture. For every overturn fatality there are approximately five non-fatal injuries, one of which is likely to result in a permanent disability (Cole et al, 2006). The economic burden of an overturn can also be crippling. Research conducted by Kelsey in New York State indicates that an overturn fatality can result in at least $250,000 in lost income (Kelsey, 1992). This is likely a conservative estimate since it is based on wage rates from over 25 years ago. Further economic analyses conducted by NIOSH (National Institutes of Occupational Safety and Health) illustrate that the eradication of overturn fatalities would eliminate roughly $3 billion in associated costs (NIOSH Center Directors, 2004).

Rollover Protective Structures (ROPS)

Tractor overturns cannot altogether be prevented. However, the fatalities and injuries associated with them can be. ROPS have been proven to provide reliable protection to tractor operators in the event of a tractor overturn (NIOSH Center Directors, 2004). This mechanism, which can take the form of either a roll bar or a cab, will hold a tractor operator within a zone of safety when used with a seatbelt, as demonstrated in Figure 2.
The first patented overturn protection device dates back to 1952. A Kentucky farmer named Osborne Maybrier applied for the patent yet never actually built the device or tried to sell it to manufacturers (Skrome, 1987). During the summer of 1954, Agricultural Engineers from the National Swedish Testing Institute for Agricultural Machinery in Uppsala worked to design and manufacture roll-over protective devices for timber harvesters working in the mountainous regions of northern Sweden. With immediate support from tractor manufacturers, legislation was passed requiring the installation of these protective devices on Swedish tractors manufactured after 1959 (Skrome, 1987). One year later (1960), John Deere, a U.S. tractor manufacturer, began to experiment with and develop ROPS for U.S. tractor models with other manufacturers quickly following suit (Job, 2008). Since then ROPS have become a mandated addition to farm tractors in most developed countries.

There is ample evidence that ROPS are a reliable and effective safety solution. When used with a seatbelt, studies indicate these devices are 99% effective in preventing injury or death (NIOSH Center Directors, 2004). In fact, there has never been a recorded fatality in the U.S. due to a ROPS failure (Job, 2008). Even without a seatbelt, rollbars have been shown to reduce the probability of death (Myers and Pana-Cryan, 2000). By increasing the energy required to sustain the roll, ROPS can prevent the tractor from completely rolling over, or if not, at least reduce the number of times the tractor is likely to roll.

With such a reliable means for preventing death, it may be difficult to understand why overturn deaths continue to plague American farmers. It is the answer to this question which stands at the heart of efforts to reduce overturn fatalities and injuries in the U.S.. Plainly stated only 59% of U.S. tractors are equipped with ROPS (NASS, 2006 Farm and Ranch Safety Survey).

Although there are various reasons for the paucity of ROPS protected tractors in the U.S., the most profound is the relatively late introduction of ROPS as a standard feature on tractors. Not until 1985, approximately 25 years after the first ROPS came off the assembly line, did American manufacturers agree that ROPS should be considered an essential piece of the tractor operating system (Job, 2008).

For those tractors manufactured between 1970 and 1985 ROPS were sold as optional, which ensured these tractors were largely ROPS compatible. However, since the cost of the ROPS was calculated over and above the cost of the tractor, most buyers elected not to purchase them. For tractors with cabs, this trend was slightly different. After 1975, tractor manufacturers began to build ROPS into the design of cabs (Job, 2008). Complicating things even further, tractors manufactured prior to 1970, were neither provided with ROPS, nor designed to accommodate a ROPS. Despite continued use on U.S. farms, these tractor owners have no viable protection from overturns. For these tractors, the axle housings (which are the attachment location for most ROPS) are often too weak to withstand the force of an overturn (Li and Ayers, 1997).

As demonstrated in an article written by Myers et al (1998) simply focusing on those tractors for which a solution exists (i.e. those which can be retrofitted but aren’t) means the retrospective installation of almost 2,400,000 tractors. Retrofitting these tractors would be a costly and complicated endeavor. The price of a rollbar or cab can range anywhere from $600 to several thousands of dollars and finding the appropriate ROPS can be a laborious, time-consuming process (Hallman, 2005). Shipping the rollbar or cab from the supplier to the farmer or installer is expensive (on average $200) and once delivered, the farmer either needs to take the time to install...
it or pay $100 to $200 for a dealer to come and install it (Viebrock et al, 2007). These hurdles, coupled with farmers’ relative lack of interest in retrofitting have created considerable challenges for researchers working to reduce tractor overturn fatalities and injuries. This challenge is adroitly summarized by agricultural researcher ML Myers when he states, “As clear as the problem and solution are, implementing the solution is difficult. It involves technically mounting ROPS on tractors that were not designed for ROPS, it involves installing ROPS on tractors against many owners’ beliefs, and the problem of “Who pays?” needs to be overcome.” (Myers, 1998).

**Educational interventions**

Over the past two decades intervention efforts in the U.S. have largely focused on educating farmers about the risks of overturns and the benefits of ROPS (Murphy, 2003). However, like many public health issues, knowledge of a particular risk does not always translate to safe behaviors. One salient example is provided by a hazard assessment study conducted in Ohio. Although 20% of principal operators surveyed had received occupational injury training, this factor was in no way predictive of the presence or absence of ROPS protected tractors on farms (Papers and Proceedings of the Surgeon General’s Conference on Agricultural Safety and Health, 1991). In a study conducted by Elkind (1993) on safety awareness and associated behaviors, she concludes “behaviors including purchasing of insurance and taking precautions appear to be unrelated to knowledge of hazards”. Despite several decades of tractor safety training in the U.S. farm community, the change in the proportion of ROPS protected tractors has been relatively slow.

**Legislation**

The failure of U.S. efforts to decisively combat overturn fatalities and injuries stands in stark contrast to the relative successes experienced in other developed countries. According to current national estimates, the rate of U.S. overturn fatalities is roughly 7 per 100,000 tractors (Myers et al, 1998). Sweden, using a combination of financial incentives and legislation, has significantly reduced the rate of overturn fatalities. In a study conducted by Thelin from the period 1957 to 1986 these measures reduced fatalities from 17 to 0.3 deaths per 100,000 tractors (Thelin, 1998). Using a similar combination of incentives and legislation Denmark and Germany have reduced their overturn rates from 30 to 2 deaths per 100,000 tractors in Denmark and 6.7 to 1.3 deaths per 100,000 tractors in West Germany. These rates are well below those recorded in the U.S (Springfeldt, 1996; Thelin, 1998). In Australia, the combination of incentives and legislation has reduced the proportion of unprotected tractors from 24% to 7% (Day et al, 2004).

Although ROPS legislation has worked effectively in other countries, this solution is a decidedly unpopular one in the U.S.. Many farmers and the industries which serve them have vociferously opposed the mandatory installation of ROPS on U.S. tractors. The lack of support for legislative measures has largely crippled attempts to mandate protection (Papers and Proceedings of the Surgeon General’s Conference on Agricultural Safety and Health, 1991).

An example of the complications relating to legislating change is given by Occupational Safety and Health Act-Code of Federal Regulations (CFR) 29. This regulation, created in 1970, calls for employers to provide ROPS tractors for all farm employees. However, in response to intense political pressure the language in the legislation was amended to prohibit use of federal funds to enforce this law on farms with less than 11 employees (OSHA, 1994). Since a 2002 study indicates...
92% of farms have less than 11 employees (Donham and Thelin, 2006) this regulation applies to few U.S. farms. Due to limited OSHA staffing and resources, enforcement of this regulation on farms with more than 11 employees is also likely difficult.

Besides the CFR 29, the only current ROPS legislation standard in the U.S. is the Department of Labor ROPS regulation found in Washington State. This regulation requires ROPS to be installed on all tractors manufactured before 1976, if they are able to be retrofitted. Unfortunately, most tractors manufactured prior to 1970 were not built to accommodate ROPS and unprotected tractors manufactured after 1976 are not subject to the legislation.

Comparisons between Washington farms and farms in other states do indicate higher proportions of ROPS on Washington farms. In addition, within Washington, higher proportions of ROPS have also been noted on farms that are subject to the legislation as compared to those which are not. However, despite this success, similar programs have not been adopted in any other states. Without a popular mandate for ROPS legislation it appears unlikely that similar regulations will be adopted in other areas of the country (Spielholz et al, 2006).

In recent years, renewed efforts have been directed at finding a solution to the ROPS retrofit dilemma. These efforts have largely abandoned an educational or legislative approach and are driven by both public and private sector agencies. A review of these efforts provides a useful backdrop for understanding the placement of the thesis research in the wider arena of current U.S. overturn reduction activities.
Study Context

U.S. initiatives to reduce tractor overturn fatalities and injuries

State based private sector initiatives
The Farm Bureau which is a state-based organization has launched financial incentive programs in a few states. These incentive programs provide $150-$300 towards the purchase of a ROPS. Over the past ten years these programs have collectively retrofitted roughly 300 tractors (Stone, personal communication).

National public sector initiatives
The National Institute for Occupational Safety and Health (NIOSH) has initiated a Tractor Safety Initiative (TSI). The goals and recommendations are largely related to revising standards in order to improve their efficacy, assessing the cost of tractor related injuries in order to effectively communicate the economic burden of tractor-related injuries, exploring potential sources for funding retrofitting incentives, and designing messages and building partnerships which lay the groundwork for a national social marketing initiative. Results from a number of these projects have been presented or published and will be used in the next few years to develop recommended guidelines for a national initiative (TSI, National Tractor Safety Initiative Website).

State based public sector initiatives
In addition to funding the national TSI initiative, NIOSH granted funding for a more targeted, state-based initiative in New York. This initiative would provide the opportunity to test the effects of a focused intervention in a shorter timeframe. The development and evaluation activities related to the New York initiative are the subject of this thesis research.

New York ROPS Social Marketing Initiative

New York Center for Agricultural Medicine and Health (NYCAMH)
The New York ROPS Social Marketing Project has it’s origins in a NYCAMH feasibility study which was launched in 2005. This feasibility study was developed to explore effective means for addressing one of the most prevalent causes of overturn fatality and injury in the New York farm community – tractor overturns. These aims are a central focus of NYCAMH’s organizational activities as it was established in 1988 by the New York State Legislature to improve the occupational health and safety of New York farmers. Overturns have been the focus of considerable NYCAMH educational activities since the organization’s beginning, however periodic measures of the proportion of ROPS protected tractors in New York have indicated that the number of tractors with ROPS has not increased dramatically (May, 2006). In light of these challenges and the growing interest in social marketing, the feasibility project was organized to explore the potential for social marketing to increase retrofitting activity.
The project activities which were carried out in 2005 and 2006, largely involved conducting a survey to assess risk exposures and retrofitting attitudes in the New York farm community. The survey was conducted prior to the thesis research, but a summary of the activities are provided following the basic introduction to the study area, in order to provide sufficient background for the thesis research. The papers featuring the results from the feasibility study are also included as appendices I and II.

Study area

According to 2005 National Agricultural Statistics Service (NASS) estimates, the number of farms (businesses with annual sales of agricultural products totaling $1,000 or more) in New York was roughly 36,000, with approximately 7,550,000 acres of land classified as agricultural farmland (NASS, Farms and Farmland Utilization 2005). Roughly 25% of the state's total land area is employed in agricultural production and the majority of this land (94%) is used to produce field crops, such as corn, hay, small grains, potatoes and soybeans. However, roughly 50% of the state's market value comes from the sale of dairy products (American Farmland Trust, 2002).

The average age of a New York farmer is 55 (NASS, New York State Agricultural Overview: 2007) which is considerably older than the average age of 40 years for all industries (US Census, 2005). Farm operators are a largely homogenous workforce, with only 1% of farm operations being owned by racial minorities (NASS, Table 53. Women Operators - Selected Operator Characteristics: 2002 and 1997). Approximately 18% of New York's farm operators are female (NASS, New York State Agricultural Overview: 2007).

There are numerous agricultural organizations and service providers in New York, the most active being Farm Bureau, Cooperative Extension, and Future Farmers of America. In addition to these, there are various commodity associations such as the Northeast Organic Farming Organization, the New York State Vegetable Growers Association, the New York Beef Producers, the Northeast Dairy Association, and the New York State Horticultural Society. The New York Farm Bureau is funded by membership fees and works to resolve economic and public policy issues facing New York's farm population and related agribusinesses. Cooperative Extensions, on the other hand, are organized through the state land-grant universities and are dedicated to the pursuit of disseminating agricultural and food systems research knowledge to farmers and rural families. The Future Farmers of America Association is organized through the U.S. Department of Education and provides students with the knowledge and experience necessary to engage in agriculture related careers. Commodity organizations are largely member funded, as with the Farm Bureau, and work to provide political representation, networking, education, and information sharing opportunities but at the commodity level.

According to most recent estimates, approximately 53% of New York farm tractors are equipped with ROPS (May et al, 2006). Much of the terrain in the eastern part of the state is hilly due to the presence of both the Catskill and Adirondack mountain chains. Farms in the eastern part of the state are relatively small compared with the farms in the western part of the state (NASS, Table 49. Summary by Size of Farm: 1997). Farm size appears predictive of the proportion of ROPS protected tractors (Loringer and Myers, 2008) and the degree to which tractor equipment is properly maintained (Hill et al, 1992). This combination of hilly terrain, small farms and the relatively high ratio of agricultural to non-agricultural traffic is found throughout the Northeast
and is most likely the reason this region experiences the highest rates of overturn fatalities (Table 1). Unfortunately, rigorous data on overturn fatalities does not currently exist in New York. Until recently, there has been no formal system for collecting agricultural fatality information and existing estimates come from newspaper clipping services, the New York Department of Health, or extension research initiatives. In an effort to provide detailed information on tractor overturn fatalities, a program entitled Fatality Assessment and Control Evaluation (FACE) was launched by NIOSH in 1982 (NIOSH, Fatality Assessment and Control Evaluation Program Website). Under the program, fatality incidents were investigated by an agricultural engineer who would be sent to examine and record information on the causes and consequences of tractor overturn fatalities. Over the course of the program, information on 34 overturn fatalities was collected. This data indicated that in New York, roughly 80% of overturn victims were either experienced or very experienced tractor operators. Thirty-two percent of these overturn fatalities were classified as farm owner deaths while 26% were family member deaths, indicating that the most frequent victims of tractor fatalities are families themselves. However, an unfortunate limitation of this program is that the mechanism for locating cases (newspaper clipping services and word of mouth) was not likely to catch all fatality events.

Table 1: Tractor overturn fatality rates by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of deaths</th>
<th>Rate per 100,000 workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>48</td>
<td>8.4</td>
</tr>
<tr>
<td>Midwest</td>
<td>211</td>
<td>6.1</td>
</tr>
<tr>
<td>South</td>
<td>180</td>
<td>6.2</td>
</tr>
<tr>
<td>West</td>
<td>36</td>
<td>1.9</td>
</tr>
</tbody>
</table>


Initial project research

The feasibility study mentioned previously included, a cross-sectional phone survey with 644 randomly selected New York farmers, stratified into six different commodity groupings (livestock, cash crop, fruit, vegetable, organic and dairy). Eighty-seven percent (562) of these farmers completed the survey and were able to provide information on; the proportion of protected tractors on each farm, their relative readiness to retrofit unprotected tractors, their risk perceptions, motivators and barriers to retrofitting and various demographic variables (gender, age, farm size, annual hours of tractor usage and presence of child operators).

The survey indicated that roughly 76,000 tractors in New York are in need of ROPS protection. Although 82% of respondents felt ROPS were important or very important, only 17% had ever considered retrofitting an unprotected tractor. Questions relating to where farmers were in their decision to retrofit revealed that the overwhelming majority of New York farmers had never even considered retrofitting. This was true across the board, regardless of farm size, age of farmer or the presence of a child tractor operator. In addition, small crop farmers had the highest proportion of respondents in the earliest stage of the retrofitting decision making process, i.e. not only had they never considered retrofitting, they did not acknowledge the importance in doing so.
Analysis of potential risk exposures indicated more significant variation between population segments. Looking at different categories of a farm's ROPS protection (i.e. no ROPS, some ROPS, and all ROPS) the survey data indicated that a disproportionate number of livestock and crop farmers were in the no ROPS category (p<.0001) (Figure 3). Comparisons of the proportion of ROPS protected tractors in each commodity strata yielded similar results, with small crop and livestock farmers showing a significantly lower proportion of ROPS protected tractors than other commodity strata. Farmers over age 54 (p=.0012, student's T-test) also had significantly lower proportions of ROPS protected tractors.

Open ended questions provided baseline data on farmers' perceived risk of overturn and potential motivators and barriers relative to retrofitting. Many farmers felt that retrofitting wasn't necessary as they were experienced or didn't have hilly terrain. Fruit farmers in particular, felt that ROPS would interfere with work which was a considerable barrier in the decision to retrofit. Farmers also stated that they would be most likely to retrofit a tractor because of general safety concerns, although the nature of their concerns was vague.

The starting point for this thesis

Although legislation has proven effective in other developed countries, this strategy is not likely to be adopted in the U.S. As previous research and current constraints indicate, reducing overturn fatalities in New York will likely require “customer-centered” solutions. Social marketing interventions work to achieve these solutions by investing considerable time and energy in understanding the issue from the population's perspective, in identifying a viable intervention target and in testing and retesting the utility and impact of intervention solutions. It is within this context that the design and evaluation of a social marketing campaign to address the issue of tractor overturns is explored in the coming sections.
Objectives

Overall objective
The overarching goal of this thesis is to explore the role of social marketing for fatality and injury prevention among farmers.

Specific objectives
• To explore perceived barriers and motivators that influence farmer’s safety decisions (Paper I).
• To design and evaluate social marketing incentives in order to implement an intervention aimed at improving safety behaviors through the retrofitting of tractors (Paper II and III).
• To evaluate the impact of a social marketing campaign focusing on changes in behavioral intent and readiness to retrofit tractors (Paper III, IV, Economic analysis and Hotline data).
Theoretical Framework

Social marketing

Social marketing works to stimulate behavior change by removing barriers and increasing motivators that exist in relation to the targeted behavior. To do this researchers are asked to consider the following tenets in the process of developing interventions:

- Invest in understanding the population's barriers and motivators to change
- Focus on behavior change, as opposed to knowledge change
- Build the intervention strategy on behavioral models
- Target specific segments of the population to ensure that intervention incentives can be tailored to specific needs

This philosophy and process are adopted from strategies used in the commercial marketing sector. Although the goal of a commercial enterprise may be different from that of public health research, i.e. selling products versus selling healthy behaviors, the challenges presented in reaching these goals are remarkably similar. For a business enterprise, marketing professionals will not be able to sell a product that has no apparent value for consumers. For social marketing researchers, health interventions which have no perceived benefits for intervention groups will not be adopted and associated measures of health will not be significantly impacted. As stated in the social marketing literature, “consumers act primarily out of self-interest as they seek ways to optimize value by doing what gives them the greatest benefit for the least cost.” (Grier and Bryant, 2005).

Figure 4: Social marketing intervention design process

Figure originally printed in Scand J Public Health, 2008 (Thesis Paper II) with reprint permission granted from journal.
In order to develop a social marketing intervention it is important to follow a series of prescribed steps in the intervention development process. Figure 4 provides a summary of the steps used in the development of the New York ROPS social marketing initiative. Each of these intervention activities was largely directed toward the ultimate goal of tailoring the intervention to the population's perceived needs. The methods employed were varied. For instance, both quantitative and qualitative methodologies were used in the collection and analysis of data. Evaluation strategies from both the epidemiological and market testing disciplines were employed. Even within research disciplines a wide variety of data gathering techniques were utilized. Quantitative measures employed both a cross-sectional study design, as well as a quasi-randomized controlled trial study design, while qualitative investigations involved the gathering of in-depth interview data and focus group data, as well as utilizing both grounded theory and concept development techniques. These approaches will be further described in the Materials and Methods sections.

In addition to incorporating these steps and research methodologies into the intervention development process, careful consideration should be given to the four “P’s” of social marketing. These are Product, Price, Place and Promotion. Continuous reflection on these concepts throughout the intervention development process increases the intervention’s potential for developing competent, highly visible solutions. “Product” is often used to refer to the targeted behavior and associated benefits and services that a developed intervention will provide. “Price” refers to the investment in money, effort, or time that individuals would be required to make in order to engage in the targeted behavior. “Place” refers to the environment in which individuals will engage or access the targeted behavior for example service locations, outlets or points of service delivery. “Promotion” refers to the advertising, spokespeople, advocates, information and community support which are associated with the behavior and the intervention (Andreasen, 1995).

**Stages of Change Theory**

Stages of change theory posits that individuals who change a particular behavior often do so in stages which can be fairly consistent regardless of the individual or behavior (Prochaska et al, 1992). These stages are:

- Precontemplation-not considering change
- Contemplation-considering change
- Decision-determination-making steps to change
- Action-changing behavior
- Maintenance-maintaining behavior change.

Although the utility of this theory for public health interventions encompasses a wide-range of intervention development activities, it is most often used in social marketing to both tailor interventions and to evaluate intervention impact.

**Tailoring Interventions**

As well as examining each stage in the process of change and the behavioral characteristics associated with individuals in each of these stages, considerable research has been dedicated to understanding which strategies and change processes can be most helpful in each stage. For example, as indicated
in Table 2, individuals in a pre-contemplation stage of change lack either the knowledge or the proper motivation to change health behaviors. For this group, activities directed at increasing knowledge of health risks or providing incentives and messages that work to reduce the barriers to change will likely have the most pronounced effect. However, these strategies are likely to be less effective for individuals who are in the maintenance stage as these individuals are concerned primarily with the maintenance of behaviors which have already been initially adopted.

**Table 2: Stages of Change: Associated Issues and Processes of Change**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Characteristic mindset</th>
<th>Challenges</th>
<th>Strategies</th>
<th>Change processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Contemplation</td>
<td>Have not considered change or do not intend to change. Are unaware of the health issue or its attending consequences or are fully aware and are not considering change, as previous failures have led them to believe it’s not possible.</td>
<td>Individuals in this stage are hard to reach, as they are not actively seeking information or in many cases they may be avoiding it.</td>
<td>Addressing individuals in this stage may either require dedicated efforts to making individuals aware of the issue, or providing incentives that no longer make behavior change perceptually out of reach.</td>
<td>Consciousness raising-increased awareness of issues, solutions and consequences. Dramatic relief-heightened emotions with corresponding relief if action is taken. Environmental reevaluation-awareness of how not changing affects others.</td>
</tr>
<tr>
<td>Contemplation</td>
<td>Have considered change and thus are aware of the change benefits.</td>
<td>Struggle with the costs of change, which may keep these individuals in a continual state of thinking, but not doing. Not good candidates for interventions that require immediate action.</td>
<td>Careful consideration of how best to reduce the costs of change have the most potential for success.</td>
<td>Self-reevaluation-framing the positive and negative affects of the behavior in term’s of the individual’s identity.</td>
</tr>
<tr>
<td>Decision</td>
<td>Have considered change and have made definitive steps towards change.</td>
<td>May struggle with taking the initial step.</td>
<td>Good candidates for “action-oriented” programs. Promising targets for intervention since money and energy can be directed towards efforts that are more likely to register success.</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Have recently changed behavior.</td>
<td>May still struggle with maintaining the change.</td>
<td>Intervention efforts which keep these individuals on track are important.</td>
<td>Self-liberation-reinforcing the individual’s confidence in their ability to change.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Change process is in place, negating the need for motivation, change programs or habituating the behavior.</td>
<td>Maintaining the targeted behavior.</td>
<td>Help individuals to avoid relapses or situations that could lead to a relapse.</td>
<td>Counterconditioning-utilizing healthy behaviors to replace unhealthy behaviors Stimulus control-remove unhealthy stimulators from the environment, replace with healthy stimulators.</td>
</tr>
</tbody>
</table>

*Source: Based on descriptions featured in Glanz, Rimer, Lewis, eds, 2002, pp 99-113.*
In addition to considering the strategies and processes of change that are associated with each stage, it is helpful to consider how pros and cons are balanced in each stage. This balance can be an influential factor in whether individuals can successfully be moved farther along the stages of change continuum. As shown in Figure 5, interventions focused on people in the pre-contemplation phase, must work to increase the “pros” related to change. As a result, interventions developed for individuals at this stage must necessarily focus on providing behavior motivators. For contemplators, intervention efforts must instead work to reduce the “cons” that are associated with change by eliminating barriers to behavior change. For those in the action phase, considered efforts should be made to increase the “pros” related to change so that they are higher than the “cons” related to change.

Evaluating interventions

As well as providing a useful means for tailoring interventions, stages of change theory can provide a helpful tool for evaluating intervention impact. Evaluations of health interventions often rely upon health outcomes as measures of intervention success. This can create difficulties when behaviors are difficult to alter and outcomes measures are not immediately affected. Although final outcomes are necessarily important to assess, it can also be useful to track the more subtle, yet important changes that occur in the process of change. Outcomes which are rare events also provide the additional challenge of providing a sample size which is large enough to ensure adequate power for statistical analysis. The benefit of using a behavioral model such as the stages of change theory to evaluate intervention success is that it permits the measure of incremental progress using more reasonable sample sizes.

Theory of Planned Behavior

The stages of change theory can be helpful in intervention development and evaluation in that it offers proven, tailored strategies for encouraging behavior change. It also provides a means for more immediate and fine-tuned measures of intervention success. However, the stages of change theory does not provide information on what factors are most influential in the decision to change.

According to the theory of planned behavior, there are three theoretical constructs that influence an individual’s intention to engage in a behavior and actual behavior change. These are the individual’s attitude towards performing the behavior, the social norms surrounding the behavior and the individual’s perceived ability to engage in the behavior (Figure 6).
These constructs are seen as encompassing any and all environmental and social factors surrounding the behavior (Ajzen and Fishbein, 1973; Glanz, Rimer, Lewis, eds, 2002). The benefit of measuring their associated relationship with intentions to perform the behavior is that this information can be used to strengthen the intervention. This can be done by strongly emphasizing those constructs which are more likely to increase behavioral intentions. These measures can also provide an indication of which behavioral constructs are most significantly impacted by an intervention, so that efforts to increase the more influential behavioral precedents can be evaluated.

Measuring the variables in the model normally involves constructing a survey with questions designed to provide direct and indirect measures of attitudes, social norms and perceived behavioral control. Direct measures of attitude are based on an individual’s predisposition towards a specific behavior using semantic differential scales such as good/bad, necessary/unnecessary, or convenient/inconvenient. Indirect measures are often conducted based on the subject’s perception of the likelihood of outcomes associated with the behavior (often using a bi-polar likely/unlikely scale). Direct measures of social norms are based on whether “influential others” approve or disapprove of the recommended behavior (using a bi-polar disagree/agree scale). Indirect measures of social norms estimate the degree to which this social referent influences the individual’s behavior (using a unipolar likely/unlikely scale). Perceived behavioral control is directly measured by assessing the individual’s perceived ability to engage in the behavior (using a semantic differential scale, i.e. disagree/agree, up to me/not up to me), while indirect measures assess the effect of factors likely to control the individual’s ability to engage in the behavior (using bipolar scales, i.e. difficult/easy, likely/unlikely). Most often direct and indirect measures are used together to create a score for each of the behavioral composites (attitudes, social norms, perceived behavioral control).

Theory of planned behavior scores can be used at one point in time to measure which constructs are most significantly associated with intention (as in a cross-sectional study) or surveys can be conducted over multiple points in time to detect differences in measures and which of these are associated with changes in intention measures, using multiple regression analysis.
Materials and Methods

Combining Multiple Methods for Multiple Purposes

Due to the varied nature of the research objectives it was necessary to employ a wide range of research methods in both collecting and analyzing data. In some phases of the intervention development process it was necessary to gain an in-depth, subjective understanding of the issue from the population’s perspective, in others it was necessary to measure attitudinal or behavioral changes and to assess the distribution of these changes in different segments of the population for purposes of comparison. Although the worlds of qualitative and quantitative research can appear diametrically opposed, the strengths of each method can work to address the shortcomings of the other (Tashakkori and Teddlie, 1998; Johnson and Onwuegbuzie, 2004).

For example, in the quest to develop a tractor overturn intervention our formative research involved conducting a quantitative survey that would enable us to measure and compare risk exposures and readiness to retrofit in different segments of the population. These data allowed us to prioritize which group would most benefit from the intervention. However, survey questions that attempted to assess individual’s perceptions of risk and attitudes towards retrofitting were vague and even contradictory at times. In order to clarify these inconsistencies and to capture the nuanced experiences of individuals in the targeted segment of the community, it was important to divert our focus from understanding what was happening in the population to what was qualitatively happening in the individuals in their specific social context. Thus an understanding of when and how to employ qualitative versus quantitative methodologies became an important part of the research process. Table 3 provides an overview of each research objective and its related research focus, study design, data source, study sample, analytical approach and thesis paper.
Table 3: Qualitative and quantitative approaches employed to achieve each of the thesis objectives

<table>
<thead>
<tr>
<th>Specific objectives</th>
<th>Research focus</th>
<th>Study Design</th>
<th>Data Sources</th>
<th>Study Sample</th>
<th>Analysis</th>
<th>Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>To explore perceived barriers and motivators that influence farmers’ safety decisions</td>
<td>Understanding the individual experience of risk exposure and risk processing and how this affects the decision to work safely</td>
<td>Qualitative -in-depth interviews</td>
<td>Qualitative research interviews</td>
<td>23 individuals sampled from commodity association lists and using purposive sampling methods</td>
<td>Qualitative -descriptive -analytical (Grounded Theory)</td>
<td>Paper I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focus group discussions</td>
<td></td>
<td>19 focus groups (55 participants) recruited at county fairs in pilot test regions</td>
<td>Qualitative -descriptive -analytical (Concept Development)</td>
<td>Paper II Paper III</td>
</tr>
<tr>
<td>To design and evaluate social marketing incentives in order to implement an intervention aimed at improving safety behaviors through the retrofitting of tractors</td>
<td>Understanding the effect potential safety messages have on targeted social groups, as well as understanding how the group processes and receives these messages</td>
<td>Qualitative -message platform testing in small groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baseline and follow-up surveys</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hotline data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To evaluate the impact of a social marketing campaign focusing on changes in behavioral intent and readiness to retrofit tractors</td>
<td>Obtaining measures of the effect of exposures for the purpose of comparing intervention effects between exposure groups</td>
<td>Quantitative -prospective quasi randomized controlled trial -descriptive data from hotline</td>
<td>Baseline and follow-up surveys</td>
<td>391 participants randomly sampled from NASS database</td>
<td>Quantitative -descriptive -analytical (ANOVA, Regression modeling)</td>
<td>Paper III</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hotline data</td>
<td></td>
<td>860 calls to the hotline</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Collecting and Analyzing Qualitative Data

In the initial phase of the research process, our objective was to gain an in-depth understanding of the targeted population’s views on risk, safety, and issues related to retrofitting unprotected tractors. We felt this understanding was a necessary step in designing an intervention that successfully addressed the needs and concerns of the target population. Using a qualitative research approach to address this specific aim was important for several reasons. To begin with, formative research had indicated farmer’s safety and retrofitting perspectives were relatively complex. Most farmers acknowledged the importance of ROPS, but still felt no need for these safety devices in their particular circumstances. As a result, it was necessary to choose a method of inquiry which could unravel the mystery of these contradictory responses and provide a window into the “lived experience”.

Qualitative research is built on the belief that it is not only possible, but necessary to capture these “lived experiences”. This involves not only understanding the meanings that are attached to a particular phenomenon, but also the way in which these meanings are socially and environmentally constructed. This can be done using any number of data collection and analysis techniques, depending on the goal of the research (Dahlgren et al, 2004; Dew K, 2007).

Qualitative data collection most often involves conducting interviews or focus groups using question guides or mind maps, observing participants and taking notes of observations or reviewing documents (Dahlgren et al, 2004; Dew K, 2007; Starks H and Trinidad SB, 2007). Methods used for the analysis of qualitative data include approaches such as phenomenology, discourse analysis, grounded theory, ethnography, case studies, action research and ethnomethodology (Creswell, 2007; Starks H and Trinidad SB, 2007).

The qualitative data collection methods employed in the thesis research involved in-depth interviews and focus group discussions. Interviews appeared to be the best method for creating an in-depth understanding of how individuals process risk and the decision to work safely. However, in order to refine and improve safety messages it was important to capture norms and attitudes at the group level, to test reactions to message prototypes and to observe how peers influenced these responses. As a result, messages were tested in focus groups.

The choice of analytical methods involved similar considerations. For understanding the concept of risk, discussed in individual interviews, it was important not just to provide a description of the lived experience, but to conceptualize the process of how risk is defined and safety is negotiated. Grounded theory is an analytical approach developed by Glaser and Strauss, which allows researchers to study the interaction of individuals and their environment in order to answer the question “what is going on” (Glaser BG, 2001; Dew K, 2007). This is done through a process of continuous comparison, summarizing and regrouping interview data into codes and thematic categories. These categories are then linked together to formulate a more abstract model or theory. Grounded theory inquiries most often focus on social processes such as causes, contexts, contingencies, consequences, co-variances and conditions. In our study, the contexts, contingencies and conditions surrounding safety behaviors and safety decisions were of paramount interest.

Focus group transcripts were analyzed with the use of concept development testing strategies. These strategies are used to test the appeal of items, services or messages for the purposes of making these “products” more appealing to consumers. The focus of the analysis is to examine what consumers like or dislike about the product or message and what they would change. Sum-
maries of consumer feedback are then used to revise the product, which in our case was a safety intervention, to improve the products appeal.

Collecting and Analyzing Quantitative Data

The objective of measuring and comparing the effect of exposure to different intervention incentives demanded a quantitative approach. The current gold-standard for assessing the cause and effect between exposures and outcomes is the randomized controlled trial. Due to the fact that study subjects were geographically allocated to regions randomly selected to receive different specific exposures, it is possible to more decisively establish that the detected changes in study variables are due to the intervention exposures and not other potentially confounding factors. Control groups allow researchers to compare the changes in study variables between groups who are exposed to a certain intervention, with those who are not.

Because the piloting of intervention incentives was meant to provide an assessment and comparison of exposure effects, efforts were made to conform to the stipulations of a randomized controlled trial (RCT). There is currently some debate about the utility of RCT for the evaluation of community health interventions and increasingly researchers have called for longitudinal evaluations that incorporate both qualitative and quantitative methodologies (Brännström et al., 1994b; Nutbeam, 1998; Eriksson, 2000; Patton, 2002; Emmelin, 2004). However, for the purposes of our research, we felt that an RCT design would be suitable since one of our major objectives was to compare the effect of campaign exposures between different regions. The random selection of study subjects for the survey and the introduction of a control group, we hoped would increase the rigor of these comparisons. Due to financial incentive stipulations which required that only New York residents receive rebates it was impossible to completely randomize incentive treatments to the different exposure groups. However, it was possible to randomly select participants within each test region and to randomly assign the treatments within each state, i.e. which region in New York received rebates or rebates and messages and which region in Pennsylvania received messages or served as the control. In order to reduce the potential for variation in pre and post measures due to the use of different subjects, the same subjects were surveyed before and after varying intervention exposures.

Comparisons of changes in baseline and follow up stages of change and theory of planned behavior measures between different groups were made using both one-way and two-way analysis of variance. These statistical measures allow researchers to compare the means between several different groups to assess whether the differences in these means are due to chance or due to treatment effect. One-way analysis is used to compare more than two groups in reference to one variable, while a two-way analysis of variance is used to compare the means for more than one variable between several groups. In addition to comparing means between different groups, chi-squared tests were used to assess the proportion of individuals having seen or not seen ads in the different pilot regions. Chi-square tests are often employed in similar comparisons of the proportion of study subjects in different groups regarding variables with one of two possible outcomes.

In order to assess the correspondence between theory of planned behavior variables, intra-individual differences in attitude, social norms and perceived behavioral control scores were calculated and compared with intra-individual differences in behavioral intention scores using the correlation coefficient. The correlation coefficient is a useful method for the statistical analysis of
continuous data and is often used to measure the linear association between study variables. As well as using the correlation coefficient to measure the association between behavioral precedents and behavioral intentions, linear regression was used to measure the degree to which changes in behavioral precedents were predictive of changes in behavioral intention. Multiple linear regression was used to determine which combination of variables was most predictive of changes in behavioral intention. This method of analysis introduces multiple explanatory variables into the equation model to assess which combinations of changes in these variables can best predict changes in the response variable.

Additional analyses of the cost-efficacy of the campaign and the impact of the campaign on retrofitting behaviors were conducted, but as yet have not been published. They are included in the thesis to provide supplemental evaluation data for the intervention. The cost analysis was conducted by means of a decision tree which was used to calculate the probability of an overturn fatality with and without the intervention. This data was compared to the cost of the intervention to calculate the cost savings relative to the intervention. Analysis of the impact of the campaign on retrofitting activity was also conducted based on the number of farmers retrofitting through the New York ROPS Rebate Program. As such, frequencies of ROPS orders were calculated for each of the study counties in New York based on data gathered from the program hotline.

**Barriers and motivators influencing farmer’s safety decisions (Paper I)**

*Data sources and analysis*

Qualitative interviews were conducted in order to gain a deeper understanding of how individuals in the target community process risk and what factors are influential in the decision to work safely, or not work safely. In addition we hoped to gain a more specific understanding of farmer’s perceptions of overturn risk and retrofitting which we believed would be of vital importance to developing an effective intervention.

Based on the data collected in the feasibility study, we decided to focus the intervention on small crop and livestock farmers as these farmers account for the highest proportion of unprotected tractors in New York. Having selected this segment, it was then necessary to identify which individuals within this group would have the experiences and perspectives necessary for developing an effective intervention. Previous experience and interactions with the farm community, led us to believe that it would be best to begin our qualitative inquiry with principal male operators. Men were selected since they account for 82% of the farm operator population and thus would provide a perspective representative of the largest segment of the target population (NASS, New York State Agricultural Overview: 2007). Principal operators were selected based on the fact that these individuals are more involved in the day to day operations of the farm and would be most likely to have the final say in machinery purchases or decisions to work safely. Besides these selection criteria, the only other stipulation was that informants have tractors which did not have ROPS.

The male principal operators were selected from a database which contained information assembled from commodity association lists. Information on farm size, tractors, and contact information was listed for each of the farms in the database. Informants were randomly selected from the database since this was the best way to reach participants who fulfilled the stated criteria.
Each of the selected principal male operators was contacted by phone and invited to participate in an interview. As interviews were conducted, transcripts were preliminarily analyzed to look for ideas or themes that could be further clarified in subsequent interviews, thereby allowing the data to guide the design of the study. Once data saturation was achieved in the principal male operator groups, interviews with other groups, such as principal female operators, farm wives and retrofitters, were conducted. These subjects were purposively sampled and identified through referrals made by interviewees and NYCAMH outreach personnel. Referrals were then contacted by phone and invited to participate. Individuals from these groups were selected based on our desire to provide perspectives that might differ from those of principal male operators on risk, safety and retrofitting. We believed these perspectives would provide potentially useful information for comparing risk exposures and perspectives. In total 23 individuals were interviewed; i.e. 7 principal male operators, 2 principal female operators, 5 farm wives, 6 retrofitters and 3 farm sons.

The interviews were conducted in participant’s homes using a semi-structured interview guide. The topics raised in the interview guide moved from general discussions relating to a typical day at work to more specific questions on experiences with overturns and issues related to retrofitting. All interviews were recorded and transcribed.

The interview material was analyzed using a grounded theory approach. Texts were thoroughly read and examined to identify important sections for coding using the Open Code qualitative analysis software (Open Code, 2007). With the assistance of Open Code, similar codes were grouped together to develop categories which were then grouped to create core categories. Through continuous consultation with transcripts these categories were then used to create a theoretical model which was firmly grounded in the text. This process is represented in Figure 7.

Figure 7: Grounded theory process used to analyze farmer interviews
Design and evaluation of social marketing incentives (Papers II & III)

Data sources and analysis

Based on information gathered in the interviews, incentives were designed to address the following retrofitting barriers: 1) cost 2) logistical difficulty and 3) pervasive optimistic bias (a belief that one is somehow exempted from a generally acknowledged risk). Funds in the amount of $200,000 annually were obtained from the New York State legislature for rebate incentives. Previous research had indicated that providing 70% of the entire cost (parts, shipping and installation) was likely to generate the most interest in retrofitting (Hallman, 2005). Stipulations for rebate funding were minimal and farmers were allowed to install their own ROPS or hire a dealer. Funds were also permitted to be used towards the purchase of rollbars, ROPS awnings or cabs, although the rebate amount was capped at $600. To address the perceived logistical barriers, a toll-free hotline was established which offered assistance with finding and pricing ROPS kits.

Appropriate social marketing messages were needed to motivate farmers’ to retrofit despite their optimistic bias. The fifteen message prototypes (See Figures 8a and b) were designed based...
MATERIALS AND METHODS

upon the findings in farmers’ in-depth interviews. Focus group discussions were organized to develop, test and revise these potential message platforms. Due to constraints in the intervention timeline, these focus groups were scheduled during the summer months when farmers are often busy. Even under more ideal conditions, organizing focus groups with more than a few farmers can be difficult, since farmers live in rural areas and are geographically dispersed. For this reason, discussion groups were conducted at county fairs, as these events were likely to draw farmers showing cattle or attending farm demonstrations.

Because finalized messages would be tested along with other intervention incentives in a pilot study, the discussion groups were conducted in the four regions selected for the pilot. Since two of the pilot regions would feature rebate incentives and the other two would not, half of the message prototypes included information on financial rebates while the other half did not.

Cooperative extension personnel, often closely acquainted with farmers and farm demonstrations, assisted in the purposive recruitment of small crop and livestock farmers for the discussion groups. The groups ranged in size from 2-6 people and separate discussions were conducted for principal male operators and farm wives, with some exceptions. This was done to allow farm wives the opportunity to express their views freely without undue influence from their husbands.

All 19 focus group discussions were performed by the same moderator who used a semi-structured guide. The farmers were asked to discuss where they would look for information on machinery upgrades and to discuss who was most often involved in decisions to upgrade ma-
chinery. They were then asked to review 7-8 message prototypes, discuss things they liked and didn’t like about the messages and then to select two of their favorites. In order to reduce the possibility of bias related to the order in which the messages were reviewed, the message order was rotated for each discussion group. The discussions lasted on average about 1 hour and each was taped and transcribed verbatim.

The analysis of data was conducted using basic concept development testing strategies (Kotler, 1988). These testing strategies largely involve the analysis of comments from targeted consumers who have been recruited to pre-test concepts in order to look for both positive and negative reactions to the “product” which in our case was message prototypes. Accordingly, focus group notes and transcripts were reviewed in order to identify participant comments and reactions which highlight the elements in concepts that were attractive, clear, persuasive, and interesting. These comments were summarized to create a concept brief which was used to revise and improve the most popular message concepts, thereby ensuring these concepts more closely mirror the needs identified by the target population. Information on the most popular message channels was also gathered and used to identify productive media targets for ad campaigns.

Evaluation of a social marketing campaign (Paper III, IV, Economic analysis and Hotline data)

Data sources and analysis

A Quasi-Randomized Controlled Trial of Social Marketing Incentives

To provide an evaluation of incentive exposure effects a quasi-randomized controlled trial was designed. Two regions in New York and two regions in Pennsylvania were selected to pilot the different intervention incentives. Each of the four regions was selected based on having a high ratio of small crop and livestock farms. A three county region in northern New York was randomly designated to

![Figure 9: New York State Pilot Test Region](image1.png)

![Figure 10: Pennsylvania State Pilot Test Region](image2.png)

*Figure originally printed in Scand J Public Health, 2008 (Thesis Paper II) with reprint permission granted from journal.*
pilot rebates with generic messages and related promotion regarding rebate availability. A five county region in central New York was selected to pilot rebates, social marketing messages and promotion. Four counties in north western Pennsylvania were selected to pilot social marketing messages and promotion (i.e. no rebates), while three counties in south central Pennsylvania were selected as the controls. A more complete description of incentive treatments in each region is given in Table 4.

The pilot is referred to as a “quasi-randomized” controlled trial since New York State legislative funding only allowed refunds to be distributed in New York. Thus it was not possible to completely randomize which regions received rebates. However, within New York the selection of which region received social marketing messages/promotion and which received rebates and generic messages was done randomly. The same was true for the selection of which region in Pennsylvania would receive social marketing messages/promotion and which would serve as a control.

Table 4: Message and Promotional Strategies Utilized in Each of the Pilot Study Regions

<table>
<thead>
<tr>
<th>Region 1*</th>
<th>Region 2*</th>
<th>Region 3</th>
<th>Region 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rebate and Hotline</strong></td>
<td><strong>Rebate, Hotline, Messages</strong></td>
<td><strong>Messages, Hotline</strong></td>
<td><strong>Control</strong></td>
</tr>
<tr>
<td>Ads: Generic ads were run in popular farm periodicals. These ads featured only the who, what, how and where of the intervention. The focus of the ad was simply to make farmers aware of the rebate and hotline.</td>
<td>Ads: Ads which were developed based on formative research and tested in focus groups were run in popular farm periodicals. All ads included information about the ROPS rebate and hotline. Ads were “flighted”, i.e. each ad was run for several months then followed by the next, to maximize message vitality and farmer interest.</td>
<td>Ads: Ads which were developed based on formative research and tested in focus groups were run in popular farm periodicals. All ads included information about the importance of retrofitting and the hotline. Ads were “flighted”, i.e. each ad was run for several months then followed by the next, to maximize message vitality and farmer interest.</td>
<td>No advertising was conducted.</td>
</tr>
<tr>
<td>Stories: A few stories were featured in papers and on radio and TV spots. Again the stories simply featured the availability of rebates and how to access the hotline.</td>
<td>Stories: Stories were featured in papers and on radio and TV spots. These stories featured testimonials from farmers who'd been adversely affected by an overturn or messages related to concerns raised in the formative research phase. Information on the ROPS rebate and hotline was also offered.</td>
<td>Stories: Stories were featured in papers and on radio and TV spots. These stories featured testimonials from farmers who'd been adversely affected by an overturn or messages and information that focused on concerns raised in the formative research phase. Information on the hotline was also offered.</td>
<td>No stories were run.</td>
</tr>
<tr>
<td>Spokespeople: Generic ads were mailed to cooperative extension offices and tractor dealerships.</td>
<td>Spokespeople: Posters based on the particular ads being “flighted” in paid advertisements were mailed to cooperative extensions, tractor dealerships and veterinarians. Coffee mugs, note pads and other promotional items were mailed as well. Fabric billboards of ads were created and posted at farms near high traffic areas.</td>
<td>Spokespeople: Posters based on the particular ads being “flighted” in paid advertisements were mailed to cooperative extensions, tractor dealerships and veterinarians. Coffee mugs, note pads and other promotional items were mailed as well. Fabric billboards of ads were created and posted at farms near high traffic areas.</td>
<td>No collaborators were contacted.</td>
</tr>
</tbody>
</table>

*Region 1 and Region 2 farmers were offered a 70% rebate up to $600 for retrofitting and hotline assistance for researching and scheduling a retrofit.

Table originally printed in Scand J Public Health, 2008 (Thesis Paper II) with reprint permission granted from journal.
While interventions were allocated at the community level, testing of treatment effects occurred at the individual level. To control for known and unknown confounding variables, farmers in each of the pilot study regions were randomly sampled from a list of farms compiled in the NASS database. NASS is funded by the U.S. Department of Agriculture to provide up to date statistics on U.S. agriculture and as such has the most complete database of farms in the country. Selected participants were then surveyed by phone before and five months after the launch of the pilot intervention. Surveys were conducted by enumerators working for NASS who were informed about the aims of the study and were trained to conduct the surveys according to the guidelines laid out in the study protocol.

Survey questions were designed to capture information on important demographic variables and to measure several behavioral indicators. Information on the number of tractors, the number of tractors with ROPS, participant age and gender and hours of tractor usage were collected. Information on financial well being and seatbelt use was also collected. To assess intervention exposure, participants were asked whether they remembered seeing ads and where they saw them. In addition to this information, two survey sections were constructed to measure individual’s readiness to retrofit and intention to retrofit based on stages of change and theory of planned behavior questions.

Theory of planned behavior questions were modeled after a previously tested survey instrument used to assess physician’s behaviors regarding blood pressure monitoring of diabetes patients (Francis et al, 2004). Social norms, perceived behavioral control and behavioral intentions were all measured using a series of statements. Participants were asked to choose between the responses: strongly disagree, disagree, neither, agree/disagree, agree, strongly agree. Examples of statements relating to social norms, perceived behavioral control or intentions are given in Figure 11.

**Behavioral Intentions:**

I **EXPECT** to retrofit at least one of my unprotected tractors with a rollover protective structure.

Strongly Disagree  Disagree  Neither Agree/Disagree  Agree  Strongly Agree

**Social Norms:**

Most people who are important to me think I should retrofit at least one of my unprotected tractors.

Strongly Disagree  Disagree  Neither Agree/Disagree  Agree  Strongly Agree

**Perceived Behavioral Control:**

The decision to retrofit at least one of my unprotected tractors is under my control.

Strongly Disagree  Disagree  Neither Agree/Disagree  Agree  Strongly Agree

**Figure 11: Survey statement assessing retrofitting intentions, norms, and perceived behavioral control**
Attitudes were measured by means of an initial phrase that ended with five dichotomous value statements that participants were asked to rate on a scale of 1 to 10 (See Figure 12).

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing a roll-over protective structure on at least one of my unprotected tractors is...</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>bad farm practice</td>
<td></td>
</tr>
<tr>
<td>not cost effective</td>
<td></td>
</tr>
<tr>
<td>inconvenient</td>
<td></td>
</tr>
<tr>
<td>unnecessary</td>
<td></td>
</tr>
<tr>
<td>irresponsible</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 12: Survey statements assessing retrofitting attitudes**

Stages of change questions were organized to assess each individual’s placement on the stages of change continuum. In order to assess an individual’s placement on the stages of change continuum they were asked a series of questions which were designed to determine where the individual was in the stages of change process. Figure 13 provides an example of how these questions were laid out and stages assigned.

**Figure 13: Survey questions designating stages of change**

Comparisons of shifts in the stages of change between regions were conducted using one-way analysis of variance statistical procedures. Comparisons of individuals’ shift in stages of change for those who had seen ads and those who had not in the four treatment regions were conducted using 2-way analysis of variance. Analysis of intention and associated behavioral precedents (attitudes,
social norms, and perceived behavioral control) were conducted using regression analysis and correlation coefficients. Regression analysis for these variables permitted researchers to assess the degree to which changes in any of the behavioral precedents would predict changes in intention to retrofit. Proportions of individuals having seen or not seen ads in the different study regions were compared using chi-square analysis.

Economic Analysis

A cost analysis assessment was conducted, as well, to evaluate the cost of the intervention relative to the costs averted due to the resulting reduction in fatality. The total of all cost savings associated with decreased rollover morbidity and mortality as a result of the campaign was estimated using the Haddix and Shaffer decision tree analysis as adapted by Myers et al (2004). The limbs of the decision tree with associated probabilities are shown in Figure 14. The probability of retrofitting a tractor before and after the campaign is based on ROPS sales in New York for the year before and one year following the intervention (DeSpain, 2007, personal communication). The New York overturn probability is based on Kentucky estimates, since probabilities in New York have not been estimated and since the probability of an overturn in New York is likely to be somewhat similar to that witnessed in Kentucky. For certain probabilities two values (primary and alternative) are presented. Sensitivity analyses were performed using each of these probabilities separately, in order to test the robustness of the conclusions. Each of these annotated probabilities is explained below.

![Figure 14: Calculating injury/fatality reduction](image-url)

*Figure originally printed in Myers and Pana-Cryan, 2000, with reprint permission granted by the J Agric Saf Health.*
Assuming independence of events, the probability of a tractor operator's placement in one of the final boxes at the left of the tree is the product of the probabilities of the legs leading to the box. From this, the actual number of tractor operators in each box was calculated by multiplying these compound probabilities by the number of tractor operators in the state. The total number of deaths in the post-campaign period was then subtracted from the analogous number in the pre-campaign period to calculate the actual number of deaths avoided as a result of the campaign. The difference in non-fatal injuries is calculated in a similar manner. These two differences were then multiplied by the cost per fatality and cost per non-fatal injury respectively and summed to obtain the total savings of the campaign. Myers et al. (2004) have estimated the total cost of a single fatality at $716,436 and the cost of a single non-fatal injury at $33,847. Other estimates, such as those proposed by Pana-Cryan and Myers (2000) were also considered. The sensitivity analysis consisted of running the above model using different combinations of probabilities and costs and observing the sensitivity of the net cost to these changes.

Hotline Data

In order to assess the impact of the piloted intervention on retrofitting activity, data from the hotline was analyzed to assess the number of individuals who'd installed ROPS through the program. Although the hotline was available in three of the study regions, i.e. the rebate region in northern New York, the rebate and message/promotion region in central New York and the message/promotion region of north-western Pennsylvania, only the New York data is featured in the results section since there were no individuals who'd retrofitted through the program from Pennsylvania. For northern and central New York, the number of farmers who'd retrofitted through the program was totaled for each of the study counties. Data on the number of farms in each of the study counties was also collected from NASS (NASS, Table 8. New York County Rankings: Number of Farms and Acreage, 1998). The proportion of farmers retrofitting was then calculated based on the number of farms in each study county.
Main Findings

Barriers and motivators influencing farmer’s safety decisions (Paper I)

*If farmers know what is unsafe, why do they often choose to accept risk?*

The Grounded Theory analysis of interviews conducted in the small crop and livestock community revealed three central themes corresponding to three core categories that relate to farmer’s risk behaviors (Figure 15).

<table>
<thead>
<tr>
<th>Theme 1</th>
<th>Consistent exposures to risk with positive outcomes makes risk normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>Risk Becomes “Normal”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme 2</th>
<th>Risk taking is often modeled/encouraged by significant others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 2</td>
<td>Risk Becomes Part of a “Farming Identity”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme 3</th>
<th>The pressure to reduce costs and save time makes risk appear cost-effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 3</td>
<td>Risk Becomes “Cost-Effective”</td>
</tr>
</tbody>
</table>

These themes refer to spheres of influence which occur at different levels; individual, collective and structural. These are similar to those found in ecological models of health behaviors (McLeroy et al, 1988; Stokols, 1992, 1996). Their influence is largely governed by factors which exist at each level, but also mutually support one another (See figures 16, 17, and 18).

**Consistent exposures to risk, makes risk normal**

Farmer’s descriptions of their farm work environment largely depicted a place where risk exposures are pervasive, but their ability to take precautions is relatively limited. One of the biggest limitations was the unpredictability of risk exposures. Animals and weather were two factors which were often cited as being both unpredictable and dangerous. This lack of predictability and the need to assess and control for myriad factors, makes working safely extremely difficult for farmers, if not impossible. As a result, risk exposures become a daily, familiar experience. As these exposures

<table>
<thead>
<tr>
<th>Individual interaction with risk exposures</th>
</tr>
</thead>
</table>

“*It gets to the point where if you’ve done something many times and you’ve managed to avert catastrophe each time, you think, probably you won’t have a catastrophe.*”

**Figure 16: Spheres of influence – risk perceptions and behaviors**
accumulate over a farmer’s lifetime, they become normal and repeated close calls give farmers the impression that they can control risk outcomes due to their knowledge and experience. This makes the unpredictable appear to be dangerously predictable and controllable. Supporting evidence of this process appears to come from the interviews conducted with farm wives, female principal operators and retirement or hobby farmers. Many of these individuals indicated they were exposed to risk much less frequently. Concurrently, they appeared to be more cautious and concerned regarding situations were they felt they could possibly be hurt.

*Risk taking is often modeled/encouraged by significant others*

In addition to the immediate risk exposures that take place on a daily basis, many farmers indicated that risk taking was also modeled by influential others, from the time when they were very young. Not only was risk taking behavior modeled by significant others, children were often encouraged to take risks such as driving tractors at a very young age or operating machinery lacking the appropriate protections. Indeed, the ability to take risk and come out on top was an identity shared by many of the informants who had spent a lifetime in farming. It is interesting to note that farm wives who had grown up farming, also witnessed risk taking behaviors by influential others. However, their views on risk-taking were more cautious than their husbands. Whether these differences stem from their gender-specified roles as children (i.e. boys being more likely encouraged to take risk than girls), or attenuated daily risk exposures when compared to husbands as an adult, was difficult to discern from the interviews.

![Figure 17: Spheres of influence – risk perceptions and behaviors](image)

*Risk is often perceived as more cost-effective than safety*

In the in-depth interviews, farmers talked about the shifting trends in farm economics and labor supply and how these trends have forced them to keep the farm functioning with less help and smaller profit margins. In previous decades, informants indicated that farm families were larger and children more interested in working on the farm. Due to meager profits, better opportunities in other fields and the constant daily demands of farming, fewer offspring stay on the farm. Hiring laborers is difficult as most affordable workers are unskilled and lack the knowledge and experience necessary to work on a farm. These structural pressures force farm-owners to do more
work with less help, lessening the time that can be devoted to safety measures. Pressures to keep the farm financially solvent encourage farmers to cut costs and informants stated that they infrequently invest time or money into safety or machinery maintenance as these things are relatively low on the list of financial priorities.

“Most farmers are going to sacrifice safety and purchase something that will get the job done as best as they think it can get done. They’ll do it [tasks] themselves with very little regard to how safe it is. They will just get a job done as economically as they can.”

**Figure 18: Spheres of influence – risk perceptions and behaviors**

*What can alter the cost-benefit equation to favor safety?*

The interviews revealed that the decision to work safely or to accept risk is largely related to the conditions of any particular risk exposure. These can include the relative ease of the safety behavior, the level of fear associated with the outcome or the perceived susceptibility to injury or death. The over-arching considerations that farmers applied to most farm risk exposures are featured in Figure 19.
The design and evaluation of social marketing incentives (Papers II and III)

*How can farmers be persuaded to retrofit unprotected tractors?*

Two of the major retrofitting barriers discussed by small crop and livestock farmers were the cost to retrofit and the difficulty related to finding the best model for the cheapest price, ordering and arranging shipping. To address these barriers it would be necessary to develop a cost-sharing strategy and to create a help-line that would assist farmers with the logistics of retrofitting. In order to help farmers with retrofitting costs, legislators were petitioned to provide annual funds for ROPS rebates. These negotiations were successful and New York legislators were able to earmark roughly $200,000 annually for rebate funding. Once the money was secured it was then important to assess what percentage of the cost should be shared. In 2005, a study conducted with New York farmers indicated that most farmers would retrofit if 70% of the cost were provided (Figure 20). As a result, the rebate funding was set for 70% of the entire cost with a $600 cap to ensure that there was enough funding to go around. Special attention was also paid to making the criteria for funding flexible. Farmers interested in the rebate program would be allowed to purchase a rollbar, ROPS awning or cab and would also be allowed to use the rebate funding towards dealer installation or for installing the ROPS themselves to keep the overall cost lower and thus save money.

![Figure 20: Farmer response to financial incentives](image)

_Figure originally printed in Hallman, 2005 with reprint permission granted by the J Agric Saf Health._

In order to make retrofitting easier for farmers, a toll-free hotline was established (1-877- ROPS-R-4-U). For farmers contacting the hotline, they would be asked to fill out a short intake form that would provide important information on their tractor and their farm. Once this information had been gathered, hotline facilitators would provide farmers with information on the different ROPS models available for their unprotected tractor. Farmers would also be given estimates for parts, shipping and installation, as well as estimates regarding the rebate amount and their out of pocket cost for each ROPS option. Contact information for the ROPS manufacturers would
also be provided so that farmers could order their ROPS at their convenience. Information and important reminders for farmers choosing to self-install would also be provided. Rebate checks were promptly processed and mailed by hotline facilitators once proof of installation had been furnished.

How can farmers be convinced that retrofitting is necessary?

Concept development testing of message prototypes yielded a number of interesting results. To begin with discussion groups indicated that family members were most often involved in the decision to upgrade machinery, an important consideration for designing the promotional campaign. In relation to influential message channels, discussion groups indicated that dealers were often consulted for information on upgrading machinery, although peers were the most trusted source of information. As stated in one discussion group, “word of mouth is a lot better than any advertisement or any dealers trying to come up with something”. Several periodicals were also listed as information sources, which would be useful information in the selection of message channels for the pilot study and final statewide campaign.

Review of message prototypes indicated that messages would need to be “eye-catching” since farmers rarely have the time to read and often skim periodicals to find the information they need. Another important consideration would be whether the ad was “thought-provoking”. Discussion group participants pointed out that a farmer’s initial response to a retrofitting would likely be dismissive and so the ad would need to be provocative enough to make him or her stop and think. To do this it would be important for messages to address concerns that would be viable to farmers.

Farmers felt messages needed to be “to the point” and “brief”. Preferred messages were ones that were succinct and which did not require the farmer to decipher the ads purpose. In addition to being brief, messages needed to be convincing. Ads that attempted to persuade farmers that they should retrofit to avoid overturn consequences were not convincing to seasoned farmers, as they believed they had the experience necessary to control adverse outcomes. Thus ads needed to be “convincing”. One exception was an ad depicting the possibility of permanent disability. This consequence, no matter how improbable, was scary enough to get them to stop and think.

Figure 21: Ads selected and revised for social marketing intervention

Ads featured here were rebate messages. Non-rebate messages were similar except for the mention of financial rebates.

Participants also indicated that the scenes and people in ads should be visually representative of their lives or “authentic”, to be seen as personally relevant. In addition, careful consideration should be given to ensuring that scenes were depicted accurately, i.e. the appropriate implements being used for the appropriate tasks. For messages featuring rebate incentives, participants felt that rebate information should be “visible” and that the cost savings to the farmer should be immediately clear. Based on this information, the three most popular ads were revised and used in the pilot evaluation (Figure 21).

Evaluation of a social marketing campaign (Paper III, IV, Economic analysis and Hotline data)

Which incentives had the greatest impact?

As the initial thesis research had indicated, small crop and livestock farmers encounter considerable barriers to retrofitting unprotected tractors. Interviews provided a list of issues that were regarded as important to address and subsequent studies provided detailed information about how to maximize the efficacy of incentives which were proposed to address them. Still unknown was how the intervention components should fit together and what impact an intervention based on these components would have on farmer’s disposition towards retrofitting.

Data from the pilot study indicated that the most effective strategy for increasing retrofitting activity in the target community would likely come from a combination of retrofitting rebates, tailored messages and promotional activities. Stages of change survey measures showed that the region receiving rebates and the region that received the combination of rebates, messages and promotion demonstrated the largest positive shift along the stages of change continuum. For these two regions, the increase in stages of change score was .25 (rebates) and .37 (rebates and messages), as compared to the other pilot regions -.12 (for both the message and control region). These numbers reflect a 25% and 37% increase in the mean stages of change scores for the rebate and rebate and message regions. ANOVA comparisons revealed these stages of change increases were significant (p=.004). The most considerable shifts in stages of change distribution occurred between the pre-contemplation and the contemplation phase in the “rebate” and “rebate and message” regions. In the “rebate and message” region there was a 21% increase in farmers in the contemplation stages of change following the pilot intervention. These results demonstrate that when farmers are offered money to offset the costs of retrofitting or are offered money in conjunction with messages and promotion, retrofitting becomes a viable consideration.

For theory of planned behavior measures, similar patterns to those seen for SOC were noted. Measures of changes in behavioral intention indicated considerable increases in the “rebate and message” region. The overall F test for the difference in change in intention scores was significant (p=.003). The most significant pairwise difference was found between the “rebate and message” region (4.3) and the “message” region (.2) (p=.009), although significant differences between change in intention scores were also found between the “rebate” (.76) and the “rebate and message regions” (4.3) (p=.03).

Although the outcome measures associated with each of the different behavioral theories indicated significant differences between treatment groups, it is important to reiterate that these theories measure different phenomenon. Stages of change scores attempt to measure where farmers are along the stages of change continuum. Survey data indicated that the greatest shift between
stages in the rebate and rebate and message region was from the “not thinking about retrofitting stage” to the “thinking about retrofitting stage”. This may provide evidence that for farmers to consider retrofitting, cost sharing programs must be made available. However, behavioral intentions were measured via the four questions featured in Figure 22.

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I <strong>EXPECT</strong> to retrofit at least one of my unprotected tractors with a rollover protective structure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I <strong>WANT</strong> to retrofit at least one of my unprotected tractors with a rollover protective structure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I <strong>INTEND</strong> to retrofit at least one of my unprotected tractors with a rollover protective structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. When, if at all, do you plan on retrofitting at least one of your unprotected tractors with a rollover protection structure?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ I do not plan to retrofit a tractor</td>
<td>□ In the next three years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ In the next year</td>
<td>□ In the next four years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ In the next two years</td>
<td>□ In the next five to ten years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 22: Questions used to assess retrofitting behavioral intentions in the pilot study**

Responses to these questions provide a better measure of the individuals plan for the future. As a result, the more pronounced increase in intention scores for the rebate and message region may indicate that while rebates will persuade a farmer to consider retrofitting, the combination of rebates, tailored messages and promotion may be the extra stimulus necessary to change consideration to intention.
Is social marketing cost-effective?

The economic analysis

Based on estimates of overturn injury and fatality rates, the cost of an overturn fatality or injury and differences in retrofitting rates in New York before and after the pilot, the savings related to injuries and fatalities averted was approximately $649,642 in the initial year. Costs to run the campaign and provide rebates amounted to approximately $264,000 in the initial year indicating a savings of roughly $385,000 in the first year of the campaign.

Figure 23: Comparison of interest generated by concept development messages versus generic messages

Can social marketing change more than attitudes and norms?  
The analysis of hotline data

Although farmers in the rebate and message regions indicated strong intentions, there were very few farmers participating in the survey who had indicated they had actually retrofitted (n=9). This may have been related to the fact that there were relatively few farmers participating in the survey (n=391). Data from the toll-free rebate hotline provides some behavior change data. Figure 23 indicates the proportion of calls to the hotline and the number of tractors retrofitted through the program based on the number of farms in each county. This data demonstrates greater hotline and retrofitting activity in the rebate and message region, as compared to the rebate region.

Which influences on behavior should a retrofitting campaign focus on?

Theory of planned behavior survey data was combined for all four regions to assess the degree to which changes in behavioral influences (attitudes, social norms or perceived behavioral control) were correlated with changes in behavioral intention. The analysis of survey data demonstrates significant correlations between the changes in all three behavioral precedents and changes in behavioral intention. However, of these, changes in social norms were found to be most significantly correlated with changes in intention (attitudes-p=.006, social norms-p<.0001, perceived behavioral control-p=.0005). Multiple linear regression analysis of behavioral precedents and behavioral intentions indicated that social norms were the best predictor of changes in behavioral intention (p<.0001) (Table 5).

Table 5: Attitudes, social norms and perceived behavioral control as predictors of behavioral intention (multiple linear regression analysis)

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF</th>
<th>Parameter Estimate</th>
<th>Standard Error</th>
<th>t Value</th>
<th>Pr &gt;</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>1.63</td>
<td>0.41</td>
<td>3.94</td>
<td>0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>1</td>
<td>0.25</td>
<td>0.17</td>
<td>1.52</td>
<td>0.1297</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Norms</td>
<td>1</td>
<td>3.31</td>
<td>0.48</td>
<td>6.92</td>
<td>&lt;.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>1</td>
<td>1.83</td>
<td>0.61</td>
<td>2.98</td>
<td>0.0031</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Methodological Considerations

The research discussed in this thesis involved consistent compromises in what we would have liked to accomplish and what we were able to achieve. To begin with, the target selection survey provided some challenges worth mentioning. To conduct this survey, samples were drawn from a database of farms which had been generated from commodity association lists. However, this database lacked farm listings for one of the designated study commodities, crop farmers, which made it necessary to contract with a separate entity (NASS). NASS then worked to identify, randomly sample and interview farmers from that commodity group. Due to confidentiality constraints on NASS databases only NASS employees are permitted to survey participants recruited via their database. Drawing samples from a database which may not be completely representative of the study population and employing different surveyors to interview a different segment of the community introduced the potential for both selection and interviewer bias.

However, a number of factors indicate that the potential for biased results was relatively small. There is little indication that commodity association members would differ from non-association members on the variables assessed in the survey. If so, these biases would likely be equally distributed throughout the commodities sampled in a similar fashion, therefore reducing the potential for sampling bias to affect comparison results. As in any sampling, some potential for bias to affect comparisons with the group sampled by NASS (crop farmers) does exist and significant differences between this group and the other commodities were detected in the analysis. However, these differences were expected and seemingly in conformity with what is known about the age, farm size and socioeconomic status of New York’s crop farmers.

In reference to interviewer bias, every effort was made to eliminate the potential for its impact on study results. Surveyors from both agencies (NYCAMH and NASS) used the same protocol, survey instruments, instructions and training by the same study coordinator. In addition, NASS surveyors were observed by the study coordinator to ensure consistency in data gathering methods between both groups. Data editing and entry were also supervised by the study coordinator.

In regards to the in-depth interviews which were conducted with small crop and livestock farmers and their families, the methods and analysis employed brought both strengths and weaknesses to the study. While qualitative research allows a researcher to enter the subject’s world to gain a more textured and “honest” picture of the subjects reality, the data is subjective and often complex.

The process itself can be extremely challenging to the researcher who must walk a fine line between gathering data which is relevant to the research question and at the same time, allowing subjects to cover the areas they find relevant. Establishing a comfortable rapport with subjects can be equally difficult. For many subjects who were aware of my position as a health and safety researcher, it was necessary to precede interviews with some general discussion of the farm or my background in farming to put them at ease. It was also necessary to establish that I was only interested in their perceptions and experiences and was not there to judge or monitor their safety behaviors. Verbal and visual cues were often employed throughout interviews to emphasize my role as a neutral listener. The choice of interview locale was also made with the aim of ensuring
subjects comfort. Conducting interviews in subject’s homes made it easier for them to disassociate me with my “work identity” and allowed me to have a more complete familiarity with their lives. Often interactions with family members or farm hands were as interesting and informative as the interview.

Having a prolonged engagement in the study area I felt a great deal of pressure to accurately represent these individual’s lives in the final data analysis. The subjective nature of the grounded theory process was initially disconcerting as I realized my role and responsibilities as the ‘research instrument’. I was fortunate to have considerable research training and a seasoned advisor to provide guidance and ‘peer debriefing’ throughout the process. Considered efforts were also made to make the process transparent in publications so that readers could judge for themselves the validity of the research process and results.

The interviews revealed a great deal of information regarding the daily lives of subjects, their interactions with risk and feelings regarding safety. In the analysis, the transcripts were reviewed with a focus on the barriers farmers encounter to working safely. Although it is impossible to know whether the final analysis accurately captured the most important concerns of farmers or whether these concerns were fairly universal in the small crop and livestock community, the methodological triangulation with focus groups, a pilot evaluation and feedback from the farm community have supported the validity of the study results.

In the pilot study evaluation similar constraints materialized in efforts to obtain a complete database for sampling. In order to make the study as rigorous as possible, NASS was contracted to randomly sample the appropriate number of small crop and livestock farms from their complete listing of New York and Pennsylvania farms. Interviewers were trained and supervisors were introduced and familiarized with the study protocols. However, in the initial baseline survey, many surveys were filled out incorrectly or were partially incomplete indicating there was some confusion on the part of NASS surveyors. As a result, in the post-intervention survey, data collection forms were edited immediately and returned to surveyors for completion or correction. Although these issues would not have affected baseline and follow-up comparisons, it did reduce the number of study participants considerably, ultimately affecting the statistical power of the study results.

The length and complicated nature of the pilot intervention evaluation surveys also introduced difficulties. Participants largely felt the survey was long and complicated and many refused to spend the 15 minutes required to complete the survey. As a result, response rates were only a little more than 50%. However, analytical comparisons between baseline scores for responders and non-responders in the follow-up survey indicate these groups did not differ significantly on behavioral measures.

Other issues related to study surveys relate to the appropriate identification of ROPS protected tractors. Although most rollbars are constructed by manufacturers who have followed the appropriate (American Society of Agricultural Engineers) ASAE testing procedures for ROPS equipment, some farmers elect to hire machine fabricators who can build these structures more economically. However, fabricated ROPS that have not been tested by ASAE standards hold no assurances of reliable protection and as such could not be counted as a “protected” tractor. In a similar fashion, cabs which do not have the ROPS incorporated into the cab design will not provide the appropriate guarantees of protection in the event of a rollover and could not be considered a
ROPS protected tractor. To address this issue and insure accurate counts of ROPS protection in surveys, owners which were unsure of their ROPS authenticity were given a list of questions by surveyors which would allow the authenticity of the ROPS to be determined.

In addition, in the pilot study evaluation, complications in the study design may have adversely affected the rigor of study results. Because the stipulations in rebate funding required that ROPS retrofitting rebates be available to all New York farmers, it was necessary to select two regions outside of New York to test the effect of messages without rebates and to provide a study control which would receive no incentives. By selecting two regions outside of New York it is possible that differences between regions could be attributed to differences in the state farm populations. This appears unlikely, as the economic and geographic similarities between farm regions in these states are few. It is also possible that message bleed over did occur between the regions as it was impossible to expose individuals to the campaign in any other way than on the community level. Hopefully, the efforts invested in distributing messages through media channels that could be restricted by county or zip code and in selecting regions that were geographically separate reduced the potential for cross-over exposures between regions. However, if messages were not entirely contained within the study regions, at least the intervention effects which were witnessed between regions were not overestimated.

Lastly, although the pilot study was a useful means for assessing the impact of potential intervention components on individual’s disposition towards retrofitting the sample size was too small to allow for the analysis of correlations between intentions and actual behavior change. Even if the hotline data was able to provide some complimentary information which indicated that farmers were indeed interested in the program, these data lacked the rigor that the controlled trial would have provided. It is our hope that future intervention development projects in neighboring states will provide another opportunity to test correlations between intentions and actual change in social marketing retrofitting interventions.
Discussion

The application of social marketing principles for injury prevention

The benefit of targeted interventions

The New York ROPS retrofitting intervention provides some indication that social marketing can work effectively to reduce the injuries in targeted populations with the important caveat that considerable investments are made in formative research and repeated evaluation. Potentially one of the most important steps in our formative research was audience segmentation. There are approximately 35,000 farms in New York State, with approximately six major commodity groups represented (NASS, New York State Agricultural Overview, 2007). If the goal of social marketing is to design an intervention which effectively removes barriers and increases motivators to change, while communicating these benefits to the community, it would be optimistic to assume that these factors would be homogenous across such a large group of individuals with heterogeneous backgrounds, farm environments and media exposures. Although stratifying communities in order to identify public health issues is not new to the injury prevention field or to public health in general, identifying targets has more frequently been confined to focusing on an injury event, age group, ethnicity or occupational group and ending there. Social marketing requires researchers to go beyond these larger groupings to compare differences in risk exposures, readiness to change, and/or media channels. In doing this it is possible to identify pockets of homogeneity within the population which are most amenable to change or which could lead to the biggest public health impact if change is induced. In the New York ROPS intervention, a survey appeared to be the most effective means for conducting comparative analyses. This survey indicated a great degree of homogeneity between farm groupings regarding their disposition to retrofitting. Although many understood the benefits of ROPS, few had considered retrofitting. Open-ended questions aimed at elucidating motivators and barriers to change indicated that although farmers were relatively similar in their readiness to retrofit, their barriers to retrofitting were somewhat different (i.e. fruit farmers had issues with the ROPS design while livestock farmers had issues with the cost). Comparisons of the percentage of ROPS protection on farms in the various strata also indicated a pronounced difference in the degree of ROPS protection on small crop and livestock farms which accounted for approximately 3/5’s of New York’s unprotected tractors. By increasing the proportion of ROPS protection on these farms, it might then be possible to give these farmers the choice of a protected tractor in the event that risky work was required.

As well as targeting research money to segments of the population which potentially most benefit from change, segmenting fosters the ability to conduct a more thorough and economical qualitative assessment of risk perceptions and change attitudes. Qualitative interviews require a great degree of time and energy in both the collection and analysis of data, and the need for at least one researcher to be present for most of these phases. Thus conducting a qualitative analysis of all types of New York farmer’s perceptions of overturn risk and disposition towards retrofitting would have been logistically difficult. Even within the more refined group of “small crop and livestock farmers”, differences in perceptions and attitudes were detected between, principal
male operators and farm wives, principal female operators and retired farmers. In light of this, it is important to remember that the more homogeneous the population is, the easier it is to develop a tailored intervention.

Removing barriers to change

The in-depth interviews conducted with farmers and their families showed that the barriers to change were numerous and both logistical and perceptual in nature. Although this may not be unusual in the larger picture of injury prevention, it points to the fact that interventions that work on both fronts may have the best chance for success. In the interviews, the cost of retrofitting was often mentioned as a barrier. This was not surprising considering the cost to retrofit is quite expensive. However, equally influential was the impact that consistent risk exposures had on farmer’s perceptions of personal susceptibility. A consistent message that was delivered in many phases of our research (i.e. the initial survey, in-depth interviews and focus groups) was that farmers with experience believed they were not susceptible to an overturn fatality or injury because they know how to avoid injury. In Weinstein’s exploration of hazard perceptions, he indicates, “People are unrealistic about their vulnerability to hazards perceived to be controllable at least in part because they are biased about the actions and psychological attributes that determine their susceptibility to such hazards” (Weinstein, 1984, p.439). This penchant for individuals to envision their personal capabilities in a self-serving fashion is supported by our research which indicated the group most confident in their ability to avoid injury or death (experienced farmers) were subsequently, the most likely group to experience injury or death (NY fatality data indicates that 80% of overturn fatality victims were experienced or very experienced tractor operators). This type of optimistic bias is cited frequently in health research and indicates that removing the logistical barriers to change alone, may not be enough to encourage change (Weinstein, 1988; Bränström et al, 2006; Kim et al, 2007; Park et al, 2008). In addition to the effects of these direct exposures to risk, individuals in our research indicated the strong influence that peers and family members have over defining risk. As evidenced by our research and other behavioral research, peers and family members help to define risk and the appropriate response to risk. As stated in the risk theory literature “The experience of risk is both an experience of physical harm and the result of cultural and social processes by which individuals or groups acquire or create interpretations of hazards.” (Kasperson, 1992, p.159).

Challenging risk perceptions and social norms in intervention campaigns, however, can be quite complicated. Attempts at convincing individuals that their interpretations are wrong can be counterproductive. According to communications researchers Dervin and Frenette, “Communication programs are doomed mostly to failure unless they focus on how audiences interpret their worlds and live and struggle in the complexes of social networks and the everyday experiences that bind them” (Public Communication Campaigns, 2000, p.72). In the formative research conducted with New York farmers, respondents revealed that a lifetime of near misses with tractor overturns provides convincing evidence that they don’t need a ROPS. This direct experience with risk and positive outcomes is likely more convincing than ads which contradict their daily experience. Communications research conducted by WJ McGuire supports the hypothesis (1999) that overcoming perceptual barriers is easier if messages are focused on already held beliefs or concerns. In fact, not only are dissonant messages often less effective, they can
have the opposite affect, leading individuals to avoid the message altogether (Nisbett and Ross, 1980; D’Alessio and Allen, 2002).

While our study has provided evidence that addressing risk perceptions in the population with campaigns that are informed by in-depth formative research may be key to changing behaviors, it also makes a strong argument for making behavior change easier. As demonstrated in the pilot, rebates played a decisive role in motivating farmers to retrofit. A frequent criticism of social marketing initiatives is that researchers make the mistaken conclusion that these initiatives are merely marketing campaigns and that persuasive messages are all that is required. However, in Andreasen’s book “Marketing Social Change” (1995) he underscores the fact that true social marketing is about providing benefits to individuals, not trying to sell them behaviors. He discusses the example of an immunization clinic that is under utilized because parents have to travel long distances to bring their children to the clinic. As Andreasen indicates, the true social marketing response would not be simply to launch a campaign urging parents that vaccinating children is the right thing to do. It would be to find ways to reduce the commute time, perhaps by introducing mobile clinics to areas with low vaccination rates and letting parents know about them (p.50). The idea of focusing intervention efforts on putting healthy behaviors in reach holds promise not just for injury prevention, but for public health in general. If one considers the myriad issues targeted in public health interventions, i.e. obesity, HIV, drunk-driving, there would be few that would not benefit by providing environmental or structural supports that make health changes easier.

When legislation is not possible

As stated in the introduction of this thesis, nearly three decades ago Sweden managed to almost totally eradicate tractor overturn deaths through engineering and legislation. By designing appropriate safety mechanisms and legislating the installation of these on all tractors, death as the result of a tractor overturn is a rare event in Sweden (Springfeldt, 1996; Thelin, 1998). The success stories in other countries have largely come about as a result of similar strategies. The difference between these countries and the U.S. is largely the presence of a political and social system which supports government intervention. In a community which vehemently opposes any government intervention, legislating healthy behaviors, is not a feasible alternative. The truth of this is witnessed in the lack of support for retrofitting legislation, despite decades of efforts by researchers to encourage this.

The New York ROPS retrofitting intervention provides some indication that social marketing techniques may be an effective alternative strategy in situations where legislation is not possible and education has failed. The New York program is currently the most successful retrofitting initiative in the U.S.. According to data provided by one major tractor distributor in New York (DeSpain, 2007, personal communication), the sale of retrofit kits following the intervention launch increased ten-fold when compared to the year prior. Although the program has only managed to increase the number of retrofitted tractors in New York by nearly 600 in two years, it stands in stark comparison to other programs in Virginia and Iowa, which have increased the number of retrofits by 300 over a 13 year period.
Targeting message channels

As with the New York retrofitting initiative, most public health campaigns are faced with the challenge of reaching populations effectively with limited time and resources. As stated by McGuire in “Constructing Social Psychology” (1999), the success of a public health campaign depends on whether individuals see, understand, agree with, retain and respond to the campaign message. By surveying New York farmers about preferred message channels for information on machinery upgrades, safety information, and good farm practices, we were able to increase message visibility and reduce advertising expenses. Message concept testing, in turn, did much to increase the probability that targeted populations would understand, agree and retain the message. Designing message prototypes based on farmer’s perceived concerns fostered the campaigns ability to increase farmer receptivity to campaign messages.

As well as targeting and testing messages, the media-mix employed in the social marketing region, appeared to effectively maximize reach and repetition. In addition to using print media advertising, information was featured on posters, on banners displayed on farms in high traffic areas, in print, radio and TV news stories on tractor overturns and through information distributed by cooperative extensions, veterinarians and the New York Farm Bureau. The effects of a multiple media approach have been examined in a literature review of health communications campaigns. According to Backer, Rogers and Sopory (1992) those campaigns which combine grassroots campaigning with mass media exposure, such as TV, radio and print media, and which repeat messages in different formats or styles, such as using earned media in conjunction with advertising were most effective. The New York ROPS intervention provides support for this finding. According to the pilot test data, 39% of participants in the true social marketing region recalled seeing the ad, as compared to 25% in the rebate region. Twenty one percent of participants in the messages only region recalled seeing the ad, even though there was no mention of rebates.

Effectively communicating and disseminating the message was a crucial step for the New York ROPS intervention where few farmers were initially considering retrofitting. Although much had been achieved in creating an intervention which responded to farmers stated concerns, this benefit would have been lost if the program had not been advertised effectively.

Gender and risk taking

Although the effect of gender on farm risk behaviors has been relatively unexplored, data related to mortality rates indicate that the fatality rate for men working on farms (23.8-32.1 deaths per 100,000 workers) is roughly 12 times greater than the fatality rate for women (2.0-3.0 deaths per 100,000 workers) (Hard et al, 1999). Injury rates describe a similarly grim picture for men. This suggests that male farmers are far more likely to engage in risky behaviors than woman (Dimich-Ward et al, 2004).

A qualitative study of Canadian farm safety practices and beliefs appears to support this hypothesis. In qualitative interviews with farmers and their wives, informants indicated that the inherent risks of farm work, the discomfort of personal protective equipment, and the hassle associated with taking time for safety were all significant barriers to safety. However, an additionally significant barrier was the need for men to adopt a typically masculine identity by engaging in risky tasks (Green, 1999). In Green's discussion of “beliefs and attitudes” she states, “Taking precautions requires farmers to acknowledge their vulnerability and susceptibility to
injury or illness, something that is at odds with their self-image of strength and competence” (p. 88).

The qualitative research conducted with our study participants describes similar gender differences in risk attitudes and risk behaviors. Principal male operators described the modeling of risk taking behaviors by older male role models, such as father or uncles. To these individuals, risk taking is a part of a farmer’s identity which is exemplified by individuals who take on risk and survive. As stated by these farmers, farming itself is one big economic gamble, where they point out, only the strong survive. However, interviews with farm wives and principal female operators demonstrated a less embracing attitude towards risk. In these women’s stories it appeared their more cautious disposition towards risk stems from an amalgamation of influences, such as gender roles established in previous generations and the freedom to select exposures since they were both willing and able to delegate dangerous tasks to husbands or hired help. In other words, while these women were comfortable in avoiding risk, their male counterparts were not.

The subordination of health as a means for constructing masculine identity is by no means unique to the farm environment. As described by W. Courtenay (2000), the health beliefs related to male masculinity are largely encompassed by the belief, “that men are independent, self-reliant, strong, robust and tough” (p.1387). The author provides a cogent argument regarding the negative impact of gender roles on numerous health indicators. This masculine identity often encourages men to subordinate health needs as a means for displaying and reinforcing male health behavior stereotypes.

Incorporating health behavior theories in intervention design and evaluation

In the preliminary stages of selecting a target population, the social marketing literature strongly suggests using the stages of change theory to identify where people are in the process of change. These data can be used as criteria for target selection (Andreasen, 1995). People further on in the process may respond more quickly to an intervention, ensuring the most success for the least investment. While we did not decide to follow that direction, we realized that periodically assessing the target placement on the stages of change continuum in various stages of testing and implementation would be beneficial for a number of reasons. By assessing pre-change states, it would be possible to specify favorable intervention effects that would be missed if only data on actual change were collected (i.e. number of individuals who retrofitted). In addition, by understanding where people were in the decision making process the appropriate strategies for the populations particular stages of change could be utilized. In the initial survey, analysis revealed that the majority of New York farmers were in the pre-contemplation phase in regards to retro-fitting. As discussed previously, change processes (i.e. consciousness raising, dramatic relief, and environmental reevaluation) were considered in the development of intervention components.

Although it would have been possible to evaluate the intervention using the stages of change model exclusively, we decided it would be beneficial to incorporate the theory of planned behavior model, as well. In particular we were interested in examining the effect of social norms and perceived behavioral control as these appeared to be influential factors in in-depth interviews. Using the theory of planned behavior model allowed us to explore two potentially important relationships in the change process, i.e. intervention effects on behavioral predictors and the degree to which change in predictors mirrored changes in intention. Regression modeling showed
that increases in social norms were more significantly correlated with increases in behavioral intention. Data also indicated that the most significant increase in intentions and social norms occurred in the rebate and message promotion region. This provides some evidence that efforts to increase social support for retrofitting in the community could positively impact the rate of tractor retrofitting. Further analysis of the relationship is necessary, however, as there is currently a debate in the behavioral science community regarding whether behaviors influence attitudes or attitudes influence behaviors.

In using both theories, it was also interesting to note the difference in outcome comparisons in the four regions. Results from the stages of change analysis indicated that rebates were the most influential component in moving individuals farther along the change process, with the largest increases experienced in regions 1 and 2. However, theory of planned behavior results indicated that the true social marketing integration of incentives, messages and promotion created the most notable changes in intention, (significantly more than the rebate only region, in fact). These differences appear to indicate that although rebates may actively encourage behaviors, by adding messages and promotion, much can be done to change the environment that influences change.

In conclusion, behavior theory was an extremely important component in both developing and evaluating the intervention. Reviews of the social marketing literature and public health interventions, in general, mirror this sentiment, calling for the more diligent usage of behavior theory in social marketing development, as well as an expansion into the usage of theories which have not typically been employed in the field of social marketing (Grier and Bryant, 2005; Mustard and Bielecky, 2007).

The ethics of social marketing

Social marketing is periodically criticized as an expostulatory approach which seeks to manipulate people into healthy behaviors. This reputation may stem from a societal distrust of marketing in general (Clifford, New York Times 2008; Owen, USA Today, 2008) or the complex ethical dilemmas that could potentially arise in marketing health behaviors (Andreasen, 2001). Some critics have lamented that these campaigns are little more than tailored persuasion or that they perpetuate the hierarchy between the researcher and the researched (Buchanan et al, 1994; Raftapoulou, The captured citizen: A critique of social marketing). In my own initial introduction to social marketing, I was also a skeptic. However, over the course of the New York social marketing project, I’ve realized that when the techniques of social marketing are employed correctly and ethically, social marketing neither perpetuates extant hierarchies, nor is it merely a series of persuasive commercials.

To address the first issue, it is important to critically consider the perceived inequity between the researcher and ‘the researched’ in driving the social marketing agenda. To put it bluntly, if social marketing seeks to improve social welfare, the question is who gets to define what these improvements will be and how these will be achieved? This concern is a valid one and it is easy to see the potential abuses that could extend from health campaigns which are short-sighted, not particularly well-informed or which do not seek the proper balance between achieving both benefits for society and for individuals. However, it would also be difficult to argue that these concerns differ in any substantive way from the concerns facing any public health initiative, be
it an educational campaign, community collaboration or technological innovation. As with any intervention, researchers must identify the health issues which are most salient and productively direct time and resources to improving associated health outcomes.

However, as opposed to many traditional health approaches, properly implemented social marketing campaigns dedicate a great deal of time and energy to understanding targeted health behaviors from the community’s perspective. This is essential to developing solutions which work for the community and which engender actual behavior change. In addition to designing interventions around the community’s needs, the community is actively involved in evaluating the campaign and driving the future direction of interventions. As in the New York retrofitting campaign, each step of the process involved interaction with small crop and livestock farmers to assess their issues surrounding retrofitting and their assessment of the proposed intervention, with the ultimate aim of creating a program that works. By removing the researcher from the “driver’s seat” and letting communities dictate the direction and substance of interventions, not only does social marketing rearrange power hierarchies, it creates programs that encourage healthy change.

As well as working to remove potential power imbalances in the researcher/researched relationship, true social marketing is not merely about advertising campaigns (Andreasen, 1995). Although there are many public health campaigns which rely solely on advertising and identify themselves as social marketing campaigns, true social marketing relies on the concept of exchange (Grier and Bryant, 2005). This concept dictates that the benefits of behavior change should be tangible and override the barriers to change (Bagozzi, 1978). By employing this concept, social marketing interventions can provide more equitable access to healthcare or healthy behaviors that may not have formerly existed. Thus instead of focusing efforts on telling people to change because it’s the right thing to do, interventions instead focus on making healthcare or healthy behaviors accessible.

In the New York ROPS Social Marketing Project every effort was made to empower farmers to make the safe and healthy decision in regards to tractor retrofitting. For farmers confused about the process of ordering ROPS or who lacked the time to research the appropriate and affordable parts, toll-free hotline assistance was made available. For those who could not afford such an expensive tractor upgrade, rebates for a considerable proportion of the cost were offered. By providing these incentives, the program was able to avoid the conundrum of many public health interventions which vehemently advocate for healthy change but which forget to provide individuals with the tools necessary to make these changes.
Conclusions and Recommendations

Over the past decade, the reduction of tractor overturn fatalities and injuries has become a public health priority in the arena of American agricultural safety and health. These devastating events quite often lead to the death of a loved one, a permanent disability, or injury which requires considerable recovery time and the loss of a productive member of the farm family. The emotional and economic stress of these events can be disastrous to family members.

Over the past few decades, researchers fighting to address the issue of overturns have employed numerous strategies to implore farmers to retrofit their unprotected tractors with ROPS. In the U.S., these efforts have largely encompassed educational or community awareness campaigns aimed at increasing awareness of ROPS in the farm community. More recently Farm Bureaus have launched state based programs offering limited rebates for retrofitting. Legislative mandates, although successful in many other developed countries, have failed to gain the popular support required to encourage legislators to push for regulation. Meanwhile, as the statistics indicate, the proportion of ROPS protected tractors in the U.S. continues to increase very slowly and is nowhere near the 75% to 80% which would be required to significantly reduce the fatality and injury rate in the U.S..

The research conducted as part of this thesis indicates that social marketing may provide a viable means for increasing retrofitting activity in the U.S.. As the initial qualitative research indicated, the barriers to retrofitting in our targeted population were both logistical and perceptual, providing clues as to why previous efforts aimed at either awareness or financial incentives have been less successful. Social marketing offers researchers a new tool box, with strategies designed to increase interaction with the targeted population and provide tailored solutions. Application of these strategies in our research allowed us to gain invaluable insight into the issue from the farmer’s perspective. What they told us was that retrofitting is an expense they feel they can’t afford, designed to avoid an injury or fatality that they believe is unlikely. Their countless exposures to risks with positive outcomes, supports their optimistic bias, while gender norms and counterproductive ideals of masculinity reinforce their risk taking behaviors.

Although our research provided insight on the many barriers farmers face in retrofitting unprotected tractors, we found clues to potential motivators, as well. The need for financial assistance was not a great surprise, but concerns about the safety of children, wives or workers and the fear of permanent handicap or debilitating injury was novel and potentially important information. These ideas when incorporated into message concepts and incentive components generated significant retrofitting activity, increasing the sale of ROPS in the social marketing test region ten-fold. As these sales and the pilot study of retrofitting incentives indicate, the combination of persuasive messages, financial/logistical assistance and promotion, will likely be the most successful means for increasing the proportion of ROPS protected tractors on U.S. farms. As our formative research indicates, interventions which seek to challenge risk taking as the preferred means for defining masculine identity may be equally important.

Applying what we’ve learned in our research to the wider arena of U.S. farm community, however, would require careful thought and planning. According to 2007 NASS estimates there
are approximately 2,075,510 farms in the U.S.. The diversity inherent in U.S. farm populations is staggering in comparison to the farm communities of many developed countries. Gathering the required resources to conduct the research and develop a social marketing campaign for all farmers, borders upon impossibility. Working to target at-risk segments of the population and ensuring that at least one or two tractors on these farms is likely a much more economical and workable strategy for the coming decades. It is also a solution which is more theoretically aligned with social marketing strategy. USDA and NIOSH data already exist to facilitate this process. States with significantly elevated overturn fatality risks have already been identified and recent NIOSH data indicate part-time farmers with meager annual farm sales are less likely to have ROPS protection. Focusing on creating solutions for these farmers and applying the lessons learned in the New York ROPS social marketing project may currently provide the greatest opportunity for reducing overturn fatality and injury rates in the U.S..
The Researcher

To quote an American Writer, “People don’t choose their careers, they are engulfed by them” (Dos Passos, 1959). My career path appears to provide a good example. Although I did not originally plan to complete a PhD in Epidemiology from a Swedish university, it now seems the logical endpoint for a rather circuitous path that has been laid with great opportunities and learning experiences.

Originally I had planned to complete a bachelors in journalism so that following college, I could travel to foreign countries and work as a foreign correspondent. After graduation, I landed a job at the local newspaper and soon realized that I could easily spend decades working my way up to a larger paper with no real guarantees that I would ever actually get a job as an overseas reporter. With this daunting prospect and an overwhelming desire to see the world, I changed gears and accepted a position teaching and doing development work in Kenya. The change of venue, I’d hoped, would provide me with an opportunity to learn the language and my way around, as well as perhaps improve my prospects in international journalism.

Living in a developing country struggling with democratic reforms, political corruption and overwhelming poverty was an eye-opening experience for me. One of the most indelible experiences from my time there was witnessing the rise of the AIDS epidemic in eastern Africa. Deaths associated with the disease left the elderly and children in many villages without providers. I witnessed World Health Organization efforts to stem the tide of AIDS by handing out condoms to women attending clinics for pre-natal or well-child visits. Having lived amongst Kenyan women it appeared to me that these women had little social agency to dictate their usage.

From this, my path in public health research was born. After returning to the states, I was determined to explore career opportunities which would allow me to apply cultural perspectives in health intervention development. After earning a Masters in Medical Anthropology, I began my search for a public health research institute which was open-minded enough to consider hiring an anthropologist.

My search led me to the New York Center for Agricultural Medicine and Health. The initial projects I worked on, developing culturally appropriate safety materials and training manuals for migrant clinicians were challenging and interesting. Eventually I found myself working on the New York ROPS Social Marketing project, a transition which has been a fortuitous opportunity. In 2007, I was also lucky to be accepted as a PhD student in Epidemiology and Public Health at Umeå University, which afforded me the opportunity to develop both qualitative and quantitative skills, a combination which was difficult to find in American Public Health schools.

Looking back over the last five years then, I am made aware of the many unique opportunities I have been granted. My dissertation research has allowed me to work directly with the farm community, to learn more about ‘farm culture’ and to use what I have learned in these encounters to develop an intervention that addresses farmer’s concerns and which hopefully has made change possible. The project has also granted me the opportunity to learn a great deal about public health research under the tutelage of many people I both respect and greatly admire.
Now with only months before the defense many people have asked me “Aren’t you glad to be done? Are you excited about being a PhD?” The only answer I can give is that the certificate and accolades are a marginal bonus. The journey and the people who have shared this journey with me, have been the ultimate gift.
Acknowledgements

The New York ROPS Social Marketing project would undoubtedly not exist if it were not for the intelligence, creativity and innovation of Dr. John May. I'd like to thank him first and foremost for letting me be a part of this project and also for his uncanny ability to know when I needed direction and when I needed to be free to explore my own directions. Not only has he taught me how to be a good researcher, he has taught me a great deal about how to be a gracious human being.

Maria Emmelin has been a crucial part of this research process, as well. In presentations we have made regarding the project, we have been asked how we were able to so adeptly capture farmer’s views on retrofitting and safety. This is in large part thanks to Maria whose oversight on qualitative methods and analysis, as well as study design and theoretical considerations have kept this study rigorous and thorough. Her dedication to my health and welfare, in addition to the research, has also made this process an overwhelmingly positive one and for that I am considerably grateful.

I owe considerable gratitude to my other advisors, Lars Weinhell and Hans Stenlund, as well. Lars has provided many insightful suggestions along the way and his consistently reliable sense of humor have contributed greatly to the sanity of many research discussions. Hans has generously provided statistical advice and guidance at every turn and has hosted many a memorable dinner party ensuring, that all of us had a good meal to look forward to at the end of a long, grueling day of research.

When I first decided to study for my PhD in Umea, I had serious concerns about the difficulty of leaving my family behind for weeks at a time. Now that I am nearing the end of my studies, I can say that at times it was quite difficult. However, for my daughter and husband they had each other and my family to help out and keep their spirits up. For myself, I had my Swedish family, Leif and Anneli Thylin, to help get me through. Words can hardly describe my gratitude to them for opening their home and hearts to me and for seeing me through many bad times and for ensuring that I had many good times to balance them out. Thanks to both of you for the immeasurable gift of your support and friendship.

Every journey starts with a first step and for me the three individuals most responsible for my first steps were Paul Jenkins, Giulia Earle-Richardson and Anne Nafziger. Paul and Giulia were optimistic enough to believe I had PhD potential and through Anne’s generous support, my introduction and acceptance into the Umeå program became possible. Thanks to all of you for keeping me on track.

I owe many thanks as well to the folks who have contributed considerable behind the scenes support. Bernadette Hodge, our research librarian, has never denied a request for help and has quite frequently gone out of her way to provide thoughtful attention to many aspects of the research and research publications. She is undoubtedly one of NYCAMH’s biggest assets. Lena Mustonen has also helped considerably, getting me to appointments, helping with paperwork, arranging figures. I have been very grateful for her talented assistance with these tasks and for the opportunity to get to know her. Thanks go to the folks at the National Agricultural Statistics
Service, in particular Steve Ropel, for agreeing to conduct the surveys related to the study. To say that these surveys were no picnic is probably a gross understatement. Many thanks go to Barbara Bayes, Sherry Wyckoff and Patrick O’Hara. They, along with many of my NYCAMH colleagues, have been crucially important to keeping this intervention afloat and have been endlessly supportive in my struggle to complete the dissertation. Thanks as well, to the research participants whose stories I have had the considerable honor to share.

Last, but most definitely not least, I’d like to thank my family; Todd, Ellie, my mother and father. All of them have made considerable sacrifices and brought limitless love and support for my rather unconventional career choices. There is no way to adequately thank them enough, except perhaps a promise to stop my pursuit of higher education here.
References


REFERENCES


Open Code 3.4 © (2007). UMDAC and Division of Epidemiology and Public Health Sciences, Department of Public Health and Clinical Medicine, Umeå University, Sweden, Website: http://www.umu.se/phmed/epidemi/forskning/open_code.html. Date accessed 09/12/08.


REFERENCES


Appendices


Rollover Protection on New York Tractors and Farmers’ Readiness for Change

J. J. May, J. A. Sorensen, P. A. Burdick, G. B. Earle–Richardson, P. L. Jenkins

ABSTRACT. Tractor overturns contribute significantly to fatalities in New York State agriculture. On–site inspections a decade ago indicated that approximately 60% of tractors were without effective rollover protection. Our objectives were: to describe the current prevalence and distribution of rollover protective structures (ROPS) on New York farm tractors, to identify characteristics associated with the absence of ROPS, to explore segmenting the New York farm community on readiness for ROPS retrofitting, and to identify demographic characteristics that might assist in this segmenting. A random selection of 644 livestock, dairy, fruit, cash crop, vegetable, and organic farms were contacted for a telephone survey. Of 562 farms (87%) participating, 102 (18.1%) had all tractors equipped with ROPS and 138 (24.6%) had none. A disproportionate number of livestock, cash crop, and organic operations had no ROPS. Rates of ROPS–equipped tractors correlated directly with farm size and annual hours of tractor operation. Older farmers had a lower proportion of ROPS tractors. The presence of a child operator did not affect the proportion of ROPS tractors. After weighting the sample, the total number of non–ROPS tractors in New York is estimated at more than 80,000. In addition to providing key farm demographics, the survey enabled placement of farmers on a “stage of change” continuum related to readiness for retrofitting. Three–quarters of New York farmers are in the “precontemplation” stage of change relative to ROPS retrofitting, and this varies little by size of operation, age of farmer, or the presence of child tractor operators. Stage of change may relate to hours of tractor operation (p = 0.05) and does relate to commodity (p = 0.003) due primarily to the higher proportion of crop farmers in the earliest stage of change. The goal of retrofitting all New York farm tractors with ROPS appears nearly as daunting as it did a decade ago.

Keywords. Agricultural fatalities, Rollover protective structure, ROPS retrofitting, Social marketing, Stages of change, Tractor overturn.

Among the various occupations in the U.S., agriculture has the dubious distinction of being consistently one of the three most dangerous. In recent years, agriculture’s fatality rates have been slightly lower than those of mining; however, agriculture employs roughly seven times as many workers, and thus remains a major public health problem (NSC, 2004).

There are ample data documenting the role of the farm tractor as the leading cause of occupational fatality and serious injury in agriculture. Data reported from the University of Iowa indicate that of all occupational fatalities in agriculture, 32% are related to the

Article was submitted for review in July 2005 as manuscript number JASH 5980; approved for publication by the Journal of Agricultural Safety and Health of ASABE in November 2005.

The authors are John J. May, MD, Director, Julie A. Sorensen, MA, Project Coordinator, and Giulia B. Earle–Richardson, MPH, Epidemiologist, New York Center for Agricultural Medicine and Health, Cooperstown, New York; Patrick A. Burdick, MS, Statistician, and Paul L. Jenkins, PhD, Director of Statistics and Computing, Bassett Research Institute, Bassett Healthcare, Cooperstown, New York. Corresponding author: John J. May, New York Center for Agricultural Medicine and Health, Bassett Healthcare, One Atwell Rd., Cooperstown, NY 13326; phone: 607–547–6023; fax: 607–547–6087; e–mail: jmay@nycamh.com.
farm tractor (Donham et al., 1997). In addition, this study found that non-fatal tractor incidents account for 264,651 lost workdays and 10,939 lost-time injuries in the U.S. Other investigators ascribe a higher proportion of all agricultural fatalities to tractors. The majority of these fatalities relate to tractor overturns with attendant severe crush injuries to the operator (Etherton et al., 1991, Murphy and Ambe, 1996).

One particularly tragic aspect of these deaths is that many could have been readily prevented by the use of proven existing technologies. Installation of cabs with rollover protective engineering on virtually all tractors in Sweden has resulted in a marked decline in the fatality rate (Springfeldt et al., 1998). Similar success has been noted in Norway and other European countries (Reynolds and Groves, 2000). In recognition of the efficacy of ROPS technology, ASAE voluntary ROPS standard S318.10 (ASAE Standards, 1985) was adopted by tractor manufacturers in 1985 (Myers, 2000). Since that time, in addition to manufacturing nearly all new tractors with ROPS, major manufacturers devoted a number of years in the 1990s to active promotion of retrofitting of older non-ROPS tractors with these structures (New Holland, 1997). Despite these efforts, at least half of America’s tractors remain without ROPS. Based on National Safety Council (NSC) data from the late 1990s, it is likely that nearly 2,000 fatalities have resulted from the continued absence of ROPS and seat belts on these tractors over the past decade (NSC, 1997).

The ten directors of the designated National Institute of Occupational Safety and Health (NIOSH) agricultural centers estimate that of the approximately 4.8 million tractors in the U.S., at least half are without ROPS and seat belt protection (NIOSH, 2004). In the Northeast, there are more troubling data. In New York State, a New York Center for Agricultural Medicine and Health (NYCAMH) study done in the early 1990s found an average of slightly less than four tractors per dairy farm (Hill et al., 1992). Extrapolating these 1990s figures to all New York State farms, a conservative estimate of 115,000 tractors on New York farms seemed reasonable, and this is in line with that projected by the 2002 Census of Agriculture (USDA, 2002). Data from three different surveys on New York State farms in the 1990s showed that only slightly more than one-third of New York farm tractors, primarily the newer ones, had ROPS (Hill et al., 1992; Hallman et al., 1997; West and May, 1998). This is despite decades of educational efforts by safety and health experts at both Cornell University and NYCAMH.

Traditionally, those concerned with agricultural safety, whether coming from an engineering or public health background, have relied heavily on education-based strategies to increase the use of ROPS and seat belts. A review of the National Agricultural Safety Database (NASD) reveals nearly 400 educational products addressing appropriate use of ROPS on farm tractors (NIOSH, 2005). Literally generations of safety specialists have urged American farmers to retrofit tractors with ROPS. Although some success with anecdote-based approaches has recently been described (Cole et al., 1999), there are limited published data demonstrating that education is an effective and efficient approach to this problem. Educational approaches, by definition, assume a deficiency in knowledge of safe behaviors and a clear link between understanding and behavior. However, as noted by Murphy (2003), there are “considerable incongruence and large disconnects between farm people’s safety knowledge, values, and practices.”

The directors of the ten NIOSH-sponsored agricultural centers have devoted considerable effort to designing a national initiative aimed at addressing tractor fatalities. The document describing this initiative repeatedly notes the importance of “social marketing” approaches as a key component of the initiative (NIOSH, 2004). Social marketing involves “the application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence the
voluntary behavior of target audiences in order to improve their personal welfare and that of their society” (Andreasen, 1995). Rather than focus on educating an audience to change its behavior, the social marketer acknowledges that in many cases the audience is already adequately educated but remains insufficiently persuaded to change behaviors in the face of the perceived costs of doing so. What is needed often is less education and more focus on understanding which segments of the target audience need some other type of intervention to motivate them toward behavior change. This approach has been used with success on such widely divergent issues as use of condoms (Stover and Wagman, 1992), use of oral rehydration solutions in developing nations (Hornick, 1991), and promotion of automobile seat belt use (Cohn, et al., 2002).

A central tenet of social marketing is that target populations can be (in fact, must be) segmented into discrete audiences before interventions are designed. Each of these “audiences” functions under a somewhat different set of motivations and perceptions of costs and benefits. Thus, messages and inducements for one audience may need to be substantially different from those for others. One important way in which these audiences may differ is their “stage of change” (fig. 1; Prochaska et al., 1992). In the “stages of change” model of behavior, there is recognition that significant decisions are seldom undertaken as a single step. Instead, decisions are approached in a stepwise fashion, with specific activities relating to the behavior change occurring at each of these stages. The key initial tasks for the social marketer are to identify the most appropriate portions of the target population and diagnose for each segment its position on the change continuum and the specific needs of each group relative to its stage of change.

Applied to agriculture, this approach differs from the educational approaches noted above, which for the most part tend to view the target population simply as adult vs. child tractor operators. Similar educational messages have traditionally been tailored for either the adult or for the child tractor operator. To undertake a social marketing approach aimed

![Diagram of the stages of change model](image-url)

**Figure 1.** Stages of change (Prochaska et al., 1992).
at enhancing ROPS retrofitting, it must be possible to identify more specific segments of ROPS decision-makers within the agricultural community and to recognize their relative position on the stages of change continuum. This study seeks to learn more about the extent of the unprotected tractor problem on New York farms and to learn about their owners’ readiness for change. This study addresses the following questions: (1) What are the prevalence and distribution of New York tractors without rollover protection? (2) What farm/farmer characteristics are associated with having non-ROPS tractors in New York? (3) Is it feasible to segment a population of farmers based on their stage of change relative to ROPS retrofitting? and (4) Can readily identifiable demographic characteristics be used for this segmentation?

Methods

Telephone Survey

With the assistance of social marketing consultants and members of the farm community, a survey questionnaire was designed with three specific aims: to describe participating farms’ tractors, to define the farm and farmer according to particular demographic characteristics, and to define a farm owner’s stage of change relative to ROPS retrofitting of all farm tractors. The entire questionnaire was administered in a five- to seven-minute telephone call. The survey instrument was pilot-tested on 17 farmer volunteers from a variety of commodities and further revised.

Previous surveys of the New York farm community have divided it by major commodity groups: dairy, livestock, fruit, vegetable, and cash crop (Hwang et al., 2000). We used these commodity groups for this study. Samples were randomly drawn from lists of New York farms by commodity as provided by either specific commodity groups or by the New York State Department of Agriculture and Markets’ Agricultural Statistical Service (NASS–NY). Once randomized, farms were contacted in sequential fashion until 80 or more qualifying farms were obtained for each of the commodities. Information was collected on the number of acres worked by cash crop, fruit, organic (see below), and vegetable farmers and the total number of animals for livestock and dairy farms in order to segment each commodity strata into large and small during the analysis phase. Respondents were farm owners and, when these were not available, the person answering the call was asked whether they were familiar enough with farm operations to answer survey questions. If so, they were asked to identify their affiliation with the farm (e.g., farm wife, farm supervisor, etc.).

Early in the course of the survey, it became apparent that organic farms (regardless of specific commodity) were likely to represent a distinct segment within the farm community. Thus, the survey was expanded to include 40 organic producers (of any commodity) randomly selected from the listing of New York organic farmers. The smaller sample size was selected based on the likelihood that all of these farms would be relatively small operations.

The Mary Imogene Bassett Hospital Institutional Review Board approved this study.

Inclusion Criteria

Any agricultural operation having membership in one of the statewide commodity groups of interest or listed with NASS–NY was included in the randomization. Farms found to be no longer in active production were excluded from any data collection. If a farm had ROPS on all tractors by virtue of purchase (i.e., the farmer had never retrofitted a tractor with ROPS), we gathered data on the farm. However, since the focus of desired behavior change in this study is retrofitting tractors currently lacking ROPS, these farms
did not qualify for the stage of change portion of the analysis. In these situations, we continued recruiting farms until we reached the target numbers described above for each commodity.

**Stages of Change**

The questionnaire responses allowed the investigators to place a subject in one of seven potential stages of change. Figure 2 demonstrates the basic structure of the questionnaire and the logic used in assigning each farmer to a specific stage of change.

The above strategy reflects modifications of the traditional stages of change that we believe are more suitable for the situation of ROPS retrofitting. Several of the stages have been subdivided to better describe the potential social marketing audiences in the New York farm community. The usual “maintenance” stage of change has limited significance for ROPS retrofit social marketing and has been dropped.

**Data Management and Analysis**

Telephone responses were entered onto hard copy and subsequently reviewed by both the telephone interviewer and one of the investigators (Sorensen). Data forms were double-entered into SAS (SAS Institute, Inc., Cary, N.C.). For analysis of size, farms were aggregated based on being either below or above the median size of the farms being sampled in a given commodity. Similarly, farmers were aggregated by age based on the median reported age.

Differences between continuous or interval–scale measures with respect to two classification levels, for example, mean age of farm owner with respect to size of respective farm (large or small), were analyzed using Student’s t–test. Differences among continuous measures with respect to three or more classification levels, for example, mean annual hours of tractor usage with respect to “no ROPS, some ROPS, or all ROPS” on farm tractors, were determined using single–factor analysis of variance (ANOVA). Relationships between pairs of continuous or interval–scale measures, for example, age of farm owner and respective percentage of farm tractors with ROPS, were explored with

![Figure 2. Stage of change assessment.](image-url)
Pearson’s correlation (r) and, when warranted, further developed using linear least squares regression analysis.

Differences in proportion with respect to nominal categorical measures, for example, proportion of tractors with or without ROPS with respect to farm commodity, were analyzed using the χ² test. Two-way contingency tables employing at least one ordinal categorical measure, for example, children using tractors (yes or no) and stage of change (1, 2, 3, 4, 5, 6, 7), were analyzed using the Cochran–Mantel–Haenszel χ² test.

When deemed appropriate, continuous measures were re–cast as categorical measures as per their median or quartile cutoff points, and then subjected to analytic methods as described above. Such an approach was used, for example, to determine “large or small” farm size from median acreage or number of livestock, or to determine a four–level classification from the quartile ages of farm owners. In addition, the stage of change scale was sometimes utilized as either a categorical or an interval–scale measure, such that results garnered in one analytic venue were corroborated with results from another. For example, while comparing scales of readiness to change between large and small farms, the Cochran–Mantel–Haenszel χ² test was used while treating stage of change as a categorical measure; Student’s t–test was used while treating stage of change as an interval–scale measure.

Continuous and categorical analyses, as previously described, were typically carried out within each distinct farm commodity group (dairy, livestock, cash crops, vegetables, fruit, and organic).

**Estimation of New York Tractor Numbers**

To improve efficiency and still ensure adequate numbers for analysis of each commodity, this survey did not sample commodities in proportion to their actual distribution within New York agriculture. To estimate the actual numbers of tractors (with and without ROPS) in the state, current data on the number of farms in each commodity and the total number of farms in the state were obtained from the New York Agricultural Statistical Service (S. Ropel, New York State Department of Agriculture and Markets, personal communication, 25 April 2005). To calculate tractor totals, the number of farms in each commodity group was multiplied by the mean numbers of tractors and tractors without ROPS per farm for that group.

**Results**

A total of 644 randomly selected New York farmers were contacted by telephone. Of these, 562 (87%) agreed to participate in the study by answering the questionnaire. The characteristics of these are described in table 1.

**Distribution of Tractors and ROPS**

Participating farms had a total of 3,269 tractors. A suitable cab or ROPS structure (as indicated by an engraved ASAE designation) was present on 1,741 (53%) of these tractors. The majority of the study farms (57.3%) had some, but not all tractors equipped with ROPS (table 2).

A considerably higher proportion of the “no ROPS” operations (fig. 3) were livestock, organic, and cash crop farms. This difference among the commodity strata was significant by χ² test (p < 0.0001).

In examining the percent of tractors with ROPS for each commodity (fig. 4), a similar pattern emerges: high percentages for dairy and vegetables, and the lowest values among livestock and cash crops. For all commodities, ROPS are more common on farms above
Table 1. Characteristics of the tractor cohort.

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
<th>Non–ROPS Total</th>
<th>No. per Farm[a]</th>
<th>Non–ROPS per Farm[a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>All farmers</td>
<td>562</td>
<td>54.3</td>
<td>378.6</td>
<td>227.1</td>
<td>2183</td>
<td>17.9</td>
<td>3269</td>
<td>1529</td>
<td>5.8</td>
</tr>
<tr>
<td>Dairy farmers</td>
<td>102</td>
<td>50.2</td>
<td>--</td>
<td>372.1</td>
<td>3117</td>
<td>18.2</td>
<td>622</td>
<td>227</td>
<td>6.1</td>
</tr>
<tr>
<td>Livestock farmers</td>
<td>120</td>
<td>55.7</td>
<td>--</td>
<td>102.9</td>
<td>846</td>
<td>21.6</td>
<td>366</td>
<td>227</td>
<td>3.1</td>
</tr>
<tr>
<td>Cash crop farmers</td>
<td>99</td>
<td>61.4</td>
<td>199.3</td>
<td>--</td>
<td>568</td>
<td>18.1</td>
<td>312</td>
<td>207</td>
<td>3.2</td>
</tr>
<tr>
<td>Fruit farmers</td>
<td>86</td>
<td>54.9</td>
<td>225.9</td>
<td>--</td>
<td>2673</td>
<td>15.4</td>
<td>624</td>
<td>335</td>
<td>7.3</td>
</tr>
<tr>
<td>Vegetable farmers</td>
<td>98</td>
<td>51.0</td>
<td>811.4</td>
<td>--</td>
<td>4905</td>
<td>17.5</td>
<td>1145</td>
<td>423</td>
<td>11.7</td>
</tr>
<tr>
<td>Organic farmers</td>
<td>57</td>
<td>50.4</td>
<td>65.2</td>
<td>--</td>
<td>767</td>
<td>10.2</td>
<td>200</td>
<td>110</td>
<td>3.6</td>
</tr>
</tbody>
</table>

[a] Mean ± standard error of the mean.

Table 2. Distribution of ROPS farms.

<table>
<thead>
<tr>
<th>Farms</th>
<th>Number (562 total)</th>
<th>Percent.</th>
<th>Tractors</th>
<th>Number (3269 total)</th>
<th>Percent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ROPS</td>
<td>138</td>
<td>24.6</td>
<td>391</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>Some ROPS</td>
<td>322</td>
<td>57.3</td>
<td>2405</td>
<td>73.6</td>
<td></td>
</tr>
<tr>
<td>All ROPS</td>
<td>102</td>
<td>18.1</td>
<td>473</td>
<td>14.5</td>
<td></td>
</tr>
</tbody>
</table>

the median size (56% ± 2%) than those below (39% ± 2%) the median (p < 0.0001 by Student’s t-test).

In addition to size and commodity, the age of the farm owner and hours of annual tractor use appear to be predictive of the prevalence of ROPS on a farm (table 3). There was no identifiable relationship between the presence or absence of a young (age <18 years) tractor operator on the farm. In multivariate analysis, the commodity and size of the farms remained significant. When each commodity was specifically examined, size was found to be marginally significant for cash crop farms and highly significant for dairy and vegetable operations. Hours of tractor usage was found to be very highly correlated with farm size and thus retained significance as an independent variable only with organic farms.
Figure 3. Distribution of ROPS farms by commodity group.

Figure 4. Prevalence of ROPS relative to commodity and farm size.

Estimated Numbers of New York Tractors without ROPS

The distribution of New York’s farms by commodity (S. Ropel, New York State Department of Agriculture and Markets, personal communication, 25 April 2005) is noted in table 4. Multiplying the number of farms in a given commodity by the mean number of tractors per farm gives the total number of tractors for that commodity. Similarly, the number of unprotected tractors can be projected by multiplying the number of farms by the mean number of non–ROPS tractors per farm for each of these major commodity groups. There are an estimated 147,000 tractors on the farms of the commodity groups surveyed. Of these, 76,000 (52%) are without ROPS.

Stage of Change Analysis

A total of 102 farms had all tractors equipped with ROPS. On five of these, the farmer had at some point retrofitted one or more of the tractors with ROPS. Thus, 97 farms were excluded because all tractors were ROPS–equipped and none of these tractors had ever been retrofitted with ROPS. The number of farms qualifying for this analysis is reduced to 465. Table 5 shows the characteristics of the study population included in this analysis.

Despite the substantial differences in the distribution of ROPS among New York farmers described above, the stage of change data generally shows homogeneity. The vast majority of the farmers contacted are in the early stages of the change progression (fig. 5).
Table 3. Relation of demographic variables to presence of ROPS.

<table>
<thead>
<tr>
<th></th>
<th>% ROPS</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
<td>39</td>
<td>&lt;0.0001[a]</td>
</tr>
<tr>
<td>Dairy</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Crop</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Fruit</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Vegetable</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Organic</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Farm size</td>
<td></td>
<td>&lt;0.0001[b]</td>
</tr>
<tr>
<td>Large</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Farmer age</td>
<td></td>
<td>&lt;0.0012[b]</td>
</tr>
<tr>
<td>&lt;54 years</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>≥54 years</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Child operator</td>
<td></td>
<td>&lt;0.5002[b]</td>
</tr>
<tr>
<td>Yes</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Annual usage</td>
<td></td>
<td>&lt;0.0001[a]</td>
</tr>
<tr>
<td>&lt;500 hours</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>500 to 1000 hours</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>1000 to 2500 hours</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>&gt;2500 hours</td>
<td>64</td>
<td></td>
</tr>
</tbody>
</table>

[a] ANOVA F test.
[b] Student’s t–test.

Table 4. Estimated numbers of New York tractors.

<table>
<thead>
<tr>
<th></th>
<th>No. of Farms</th>
<th>Tractors per Farm</th>
<th>Non-ROPS Tractors per Farm</th>
<th>Projected Total Tractors</th>
<th>Projected Non-ROPS Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>6,531</td>
<td>6.1</td>
<td>1.9</td>
<td>39,839</td>
<td>12,409</td>
</tr>
<tr>
<td>Livestock</td>
<td>9,852</td>
<td>3.1</td>
<td>2.2</td>
<td>30,541</td>
<td>21,674</td>
</tr>
<tr>
<td>Cash crop</td>
<td>11,813</td>
<td>3.2</td>
<td>2.1</td>
<td>37,802</td>
<td>24,807</td>
</tr>
<tr>
<td>Fruit</td>
<td>2,224</td>
<td>7.3</td>
<td>3.9</td>
<td>16,235</td>
<td>8,674</td>
</tr>
<tr>
<td>Vegetable</td>
<td>1,764</td>
<td>11.7</td>
<td>4.3</td>
<td>20,639</td>
<td>7,585</td>
</tr>
<tr>
<td>Organic</td>
<td>428</td>
<td>3.6</td>
<td>2.0</td>
<td>1,541</td>
<td>856</td>
</tr>
<tr>
<td>All farms</td>
<td>32,612</td>
<td>4.5</td>
<td>2.3</td>
<td>146,597</td>
<td>76,005</td>
</tr>
</tbody>
</table>

Table 5. Study subject characteristics for the stage of change analysis.

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live–stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>Non-ROPS Total</td>
</tr>
<tr>
<td>All farmers</td>
<td>465</td>
<td>54.3</td>
<td>±0.62</td>
<td>321</td>
<td>±41.5</td>
<td>212</td>
<td>2223</td>
</tr>
<tr>
<td>Dairy farmers</td>
<td>82</td>
<td>50.4</td>
<td>±1.42</td>
<td>--</td>
<td>±52.3</td>
<td>328.4</td>
<td>3321.9</td>
</tr>
</tbody>
</table>
Table 5 (cont.). Study subject characteristics for the stage of change analysis.

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-ROPS Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No. per Farm[a]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Non-ROPS per Farm[a]</td>
<td></td>
</tr>
</tbody>
</table>

Livestock farmers

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>55.3</td>
<td>--</td>
<td>110.9</td>
<td>793.8</td>
<td>20.4</td>
<td>320</td>
</tr>
<tr>
<td></td>
<td>±1.45</td>
<td>±24.3</td>
<td>±87.1</td>
<td>±0.22</td>
<td>±0.18</td>
<td></td>
</tr>
</tbody>
</table>

Cash crop farmers

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>61.6</td>
<td>211.6</td>
<td>--</td>
<td>539.2</td>
<td>18.9</td>
<td>292</td>
</tr>
<tr>
<td></td>
<td>±1.21</td>
<td>±34.5</td>
<td>±89.2</td>
<td>±0.22</td>
<td>±0.16</td>
<td></td>
</tr>
</tbody>
</table>

Fruit farmers

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>54.8</td>
<td>194.3</td>
<td>--</td>
<td>2734</td>
<td>15.9</td>
<td>567</td>
</tr>
<tr>
<td></td>
<td>±1.46</td>
<td>±23.5</td>
<td>±432.4</td>
<td>±0.63</td>
<td>±0.42</td>
<td></td>
</tr>
</tbody>
</table>

Vegetable farmers

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>50.3</td>
<td>667.3</td>
<td>--</td>
<td>5055.2</td>
<td>16.6</td>
<td>951</td>
</tr>
<tr>
<td></td>
<td>±1.40</td>
<td>±130.4</td>
<td>±813.7</td>
<td>±0.83</td>
<td>±0.51</td>
<td></td>
</tr>
</tbody>
</table>

Organic farmers

<table>
<thead>
<tr>
<th>No.</th>
<th>Age[a]</th>
<th>Acres[a]</th>
<th>No. of Live-stock[a]</th>
<th>Tractor Hours[a]</th>
<th>Percent with Children on Tractors</th>
<th>Tractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>50.8</td>
<td>70.3</td>
<td>--</td>
<td>694.2</td>
<td>10.5</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td>±1.79</td>
<td>±22.3</td>
<td>±94.1</td>
<td>±0.32</td>
<td>±0.28</td>
<td></td>
</tr>
</tbody>
</table>

[a] Mean ±standard error of the mean.

Figure 5. Distribution of New York farmers by stage of change (n = 465).

By univariate analysis, the distribution of the stage of change appears to be unrelated to the size of the farm or age of the farmer and not significantly related to the presence of a child tractor operator (table 6). There does appear to be a clear relationship between certain commodities and the farm owner’s stage of change relative to ROPS retrofitting of tractors. As can be seen in table 6, the differences primarily relate to the relative excess of cash crop farmers in the earliest change stage, with a corresponding paucity of crop farmers in the later stages. This contrasts mainly with the relatively large number of fruit farmers in the Action I stage. This observation is supported by analysis of variance treating the stage of change as an interval scale variable (F = 3.66; p < 0.003).
Discussion

Two of our goals dealt with defining the number and distribution of unprotected tractors in New York and defining characteristics associated with this. Some of this information is available in previous publications (cited below) or in the USDA Census of Agriculture (USDA, 2002). However, our data provide new and unique information on the prevalence of ROPS–equipped tractors relative to commodity, farm size, and a variety of other demographic variables. Extrapolating from these data, the commodities studied account for roughly 147,000 tractors across the state. Of these, 76,000 (52%) do not have ROPS. Three-fifths of these are on either crop farms (32.6%) or livestock farms (28.5%), with the next largest category being dairy at 16.3% of all unprotected tractors. The absence of ROPS was more notable on smaller farms, farms owned by older farmers, and farms with fewer overall hours of tractor operation (which correlated closely with size). The presence of at least one child operator on a farm did not seem to influence the likelihood of having ROPS protection.

The tractor figures cited above are estimations. They are higher than those projected in the 2002 Census of Agriculture (USDA, 2002), which estimated 112,000 tractors on 33,000 farms. However, it is more likely that our calculations represent an underestimation of both total tractors and total unprotected tractors. The New York State Department of Agriculture and Markets (NYS, 2003) counts a total of 37,000 farms in the state. The commodities studied in this survey accounted for 88% of these farms. The remaining

<table>
<thead>
<tr>
<th>Table 6. Relation of demographic variables to stage of change.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precontemplation</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Knowl. (%)</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Large</td>
</tr>
<tr>
<td>Small</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>&lt;45</td>
</tr>
<tr>
<td>46 to 53</td>
</tr>
<tr>
<td>54 to 62</td>
</tr>
<tr>
<td>&gt;62</td>
</tr>
<tr>
<td>Child operator</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Annual usage (hours)</td>
</tr>
<tr>
<td>&lt;500</td>
</tr>
<tr>
<td>500–1000</td>
</tr>
<tr>
<td>1000–2500</td>
</tr>
<tr>
<td>&gt;2500</td>
</tr>
<tr>
<td>Commodity</td>
</tr>
<tr>
<td>Dairy</td>
</tr>
<tr>
<td>Livestock</td>
</tr>
<tr>
<td>Cash crop</td>
</tr>
<tr>
<td>Fruit</td>
</tr>
<tr>
<td>Vegetable</td>
</tr>
<tr>
<td>Organic</td>
</tr>
</tbody>
</table>

^[a] Sig. = significance; Mantel–Haenszel statistic.
farms likely represent an extremely heterogeneous group of generally smaller farms. It is impossible to speculate about these with any hint of accuracy, other than to acknowledge that there are more, possibly somewhat less than 12% more, protected and unprotected tractors in New York than has been calculated. In light of this, 80,000 unprotected tractors appears to be a conservative estimate for New York.

Our figures appear to be generally consistent with previous New York State work. The calculated frequency of unprotected tractors on New York farms has declined somewhat from the rates noted a decade or more ago in a series of other New York studies, several of which used direct on-farm inspection. Data from NYCAMH/Cornell University tracking of New York farm fatalities from 1985 to 1989 showed that 52 (55%) of fatalities related to farm tractors (J. Pollock et al., unpublished data, 1989). Of these tractor fatalities, 27 (52%) related specifically to tractor overturns. In response to these findings, investigators undertook a series of studies in the 1990s to better define the problem. Three of these involved physical inspections of tractors. Initially, a systematic on-farm inspection of all (605) tractors on 136 randomly selected dairy farms across New York State was performed. This survey, which was linked with a concurrent one-on-one training session with each farmer, found appropriate ROPS on 33% of the tractors inspected (Hill et al., 1992). In subsequent work, all tractors offered at a series of farm auctions across the state, a total of 233 tractors, were systematically evaluated against published ASAE standards. Findings here included the presence of ROPS on 32% of tractors inspected (West and May, 1998). The most recent and most extensive study of tractors in New York was in the NIOSH-sponsored New York Farm Family Health and Hazard Survey (FFHHS), which concluded data gathering in the mid-1990s (Hallman et al., 1997). Here, a research team from the NYS Department of Health, Cornell University, and NYCAMH linked extensive health, safety, and attitudinal data collected by telephone interviews with actual on-farm hazard surveys and health screening data. Systematic inspections of the mechanical equipment were done by the Cornell team on a cohort of 580 farms that were selected to reflect the size and commodity distribution of all New York farms. The FFHHS project described a fleet of 2,513 tractors with significant safety defects. This included ROPS being absent on 61.4% tractors and seat belts absent on 28% of those tractors that did have ROPS. Some improvement in the rate of ROPS availability is suggested by these data, with rates of 33% ROPS in the early 1990s rising to 48% of tractors having ROPS in our current data.

Our other two research questions dealt with the farmers’ stage of change and possible ways to segment this population. The stage of change portion of our work demonstrates that most New York farmers are not contemplating ROPS retrofitting in the near future. Stage of change appeared to be fairly evenly distributed across most of the commodities and nearly all other farm characteristics. The statistical difference in stage of change noted in table 6 mainly reflects the fact that one commodity (cash crops) is notably less progressed on the change continuum than other commodities. Total tractor hours was the only other farm characteristic that might be indicative of a farmer’s individual stage of change. Our findings suggest that appeals to fruit farmers might be based on the observation that one in five have already retrofitted. Cash crop farmers seem less likely to retrofit than other farmers, possibly because of less understanding of the benefits of ROPS. For the social marketer, it is incumbent to better understand why this group is less knowledgeable than their peers in other commodities. It is likely that the approach to this segment must include more direct education before it is likely to be very persuasive. Statistical differences notwithstanding, the stage of change data suggest that, for the most part, other commodity groups are only slightly more inclined than their crop farmer peers to retrofit.
Some of this is not unexpected, based on previous tractor investigations done by the Northeast Center for Agricultural Health (NEC) in the New York farm community. Hallman (2005) reported on the response of farmers to varying levels of cash reimbursement for expenses of ROPS retrofitting a tractor of their choice. Notably, 20% of those offered full reimbursement rejected the offer. Cash incentives exceeding 50% had to be offered before any substantial response was experienced. Kelsey et al. (1996a) have previously reported similar reluctance to retrofit following a series of interviews with New York farmers.

In our current survey, farmers tended to agree that ROPS are important to have on tractors (Sorensen et al., 2006). However, respondents usually seemed to have reasons why they did not feel this applied to their particular situation. Though there is some evidence of variation in stages of change between commodity groups, these are mostly of little interventional significance. These data clearly illustrate why decades of educational initiatives promoting ROPS retrofitting have not proven successful in New York. Those in precontemplation, a clear majority of New York farmers, are for the most part well aware of the safety advantages of ROPS and of the potentially fatal outcomes associated with tractor overturns. They simply do not relate this understanding to their personal situation and thus have little motivation for change. Weinstein’s (1988) precaution adoption process describes this situation well in the “stages of belief about susceptibility to harm.” In this model, recognition of a general problem and acknowledgement of personal susceptibility to that problem are sequential, but substantially different stages. Movement from the recognition stage to the acknowledgement stage is challenging and often is hampered by a variety of “optimistic biases,” i.e., beliefs that one’s personal risk is somehow less than that faced by others.

There are several sources of potential error in this study. Most of the sampling was based on commodity group membership lists. All surveyed farms were randomly selected, and the response rate (87%) was high enough to suggest that the results are representative of all listed farms. To the extent that these lists are not representative of the farms in each commodity, these data may be biased. When these lists were not available, lists from NASS–NY were used, necessitating that the surveys be conducted by their telephone interviewers. This change in interview staff may have introduced some inconsistency in the data, though these interviewers were specifically trained and their results overseen by one of the authors (Sorensen). This survey was telephone–based and farmers’ responses were not validated by visual inspection. Farmers could have misrepresented their tractor fleet, though this seems unlikely. Somewhat more problematic is ensuring that the cabs and non–cab structures on these tractors actually meet ASAE standards and thus should be counted as ROPS. On occasion, farmers evidenced some uncertainty about this, particularly in the case of some older tractors with cabs. In these situations, farmers were re–contacted after they had a chance to check for the ASAE emblem on the cab signifying compliance with standards.

Several basic decisions were made in the design of this research. Our decision to define farmer age and farm size relative to commodity medians reflects an inability to determine generally accepted criteria regarding when a farm is “large” or when a farmer is “old.” Evaluation of our findings would be easier for readers if there were generally accepted criteria to which we could refer for these comparisons. A decision was made to exclude from the stage of change analyses any farms that had all tractors protected with ROPS, unless at least one of these tractors had been ROPS retrofitted by the farmer. This resulted in 97 farms being excluded. These farmers were excluded because we believed them to be outside of the stage of change spectrum. It is possible that some of those excluded may have actually bought a tractor specifically to obtain ROPS protection and thus should have been included in the stage of change analyses. Based on our interactions
with New York farmers, we believe that this would represent a very small fraction of the 97 farmers excluded.

Conclusions

The survey revealed some encouraging findings. There appears to be a trend toward higher rates of ROPS tractors in the state over the past 15 years. The proportion of farms where all tractors were ROPS-equipped (18%) was higher than might have been predicted. Prevalence of ROPS in some commodities proved to be substantially higher than was expected. The vast majority of New York farms (75.4%) have access to at least one tractor with appropriate protection. Though we did not gather this information, Kelsey’s (1996b) previous work indicates that New York farmers tend to select these ROPS-equipped machines for most of their more extensive fieldwork. It is unclear whether they chose these tractors for use on hilly or uneven terrain, where they perceive a greater risk of overturn.

The survey also illustrates some considerable challenges for social marketing. There are an estimated 80,000 unprotected tractors in the state, and their owners seem generally unpersuaded that these need to be retrofitted. Even if they were anxious to retrofit, the financial challenge here is considerable; a very conservative estimate for retrofitting even half of these is roughly $20 million. Finally, as Hallman (2005) has found in this state, it is often unlikely that appropriate retrofit kits can be promptly located and installed by dealers.

Acknowledgements

This research was supported by funding from the National Institute for Occupational Safety and Health Cooperative Agreement No. U50 OH007542 – The Northeast Center for Agricultural Health. The authors would like to thank the New York State Department of Agriculture and Markets’ Agricultural Statistical Service and the Academy for Educational Development in Washington, D.C., for their assistance with the survey and other data, and Nancy Weissflog for her editorial assistance.

References


Risk Perceptions, Barriers, and Motivators to Tractor ROPS Retrofitting in the New York State Farm Community

J. A. Sorensen, J. J. May, P. L. Jenkins, A. M. Jones, G. B. Earle-Richardson

Abstract. The prevalence of tractor rollovers among agricultural workers has made the retrofitting of tractors with rollover protective structures (ROPS) and seat belts a public health priority for agricultural health and safety specialists. To address this concern, the New York Center for Agricultural Medicine and Health (NYCAMH) developed a seven-question survey, designed to assess perceptions of risk as well as potential motivators and barriers to retrofitting. Data from 465 phone surveys were gathered from New York State farmers representing various commodities and farm sizes. Analysis of responses to three qualitative questions contained in the survey indicated that most farmers in New York understand the importance of ROPS but lack the proper motivation to consider retrofitting. It appears that more convenient safety strategies, cost, and age of the tractor compete with a farmer’s initiative to retrofit. In addition, survey responses illustrate that although many farmers believe ROPS are important in a general sense, many believe that this safety measure is not necessary for them in particular. Frequent motivators to retrofitting are concerns about safety, although the authors conclude that a more thorough analysis of these “general safety concerns” in qualitative interviews is important.

Keywords. Agricultural fatalities, Agricultural safety, Retrofit, Risk perceptions, Rollover protective structures, Social marketing, Tractor fatalities, Tractor safety.

Deaths connected with tractor operation are the leading cause of workplace fatalities among farmers in the U.S. and have been a priority for agricultural health and safety specialists for many decades (NIOSH, 2004). Tractor overturns account for nearly half of these tractor-related fatalities (NSC, 2004; Etherton et al., 1991; Murphy and Ambe, 1996). The consequences of these overturns can be prevented with the presence of a rollover protective structure (ROPS) and the use of a seat belt (Morgan et al., 2002; Reynolds and Groves, 2000). This safety innovation resembles a roll bar and serves to create a protective zone around the tractor operator, should a rollover occur. When used with a seat belt, a ROPS is 99% effective in preventing injury to the tractor operator in the event of a tractor rollover (NIOSH, 2004; Morgan et al., 2002). The relative effectiveness of ROPS in preventing tractor fatalities has been demonstrated in marked reductions in mortality rates in several countries that have introduced legislation.
mandating ROPS (Thelin, 1998; Reynolds and Groves, 2000). For example, in Sweden, tractor deaths were reduced from 17.0 to 0.3 per 100,000 tractors over three decades with the passage of mandatory ROPS laws (i.e., rollover protective structures that were mainly crush-proof cabs) (Springfeldt et al., 1998).

Unfortunately, as many as half of U.S. tractors lack this protective device and seat belts. Although ROPS have been a safety addition on all tractors manufactured in the U.S. after 1985 (manufacturer voluntary standard on all tractors over 20 hp; ASAE Standards, 1985), many tractors manufactured without ROPS prior to this date are still in use. Varying estimates of the percentage of ROPS-equipped tractors in the U.S. exist. During the late 1980s, researchers estimated that 19% of Pennsylvania tractors had ROPS (Huizinga and Murphy, 1989); in the 1990s, a survey on New York farms found that 39% of tractors had ROPS (Hallman et al., 1997). During a similar period, national estimates indicated that approximately 38% of tractors had ROPS (Myers and Snyder, 1995).

Many efforts have been directed at encouraging farmers to retrofit their tractors, including safety education programs, community-based awareness campaigns (Struttmann et al., 2001; Myers et al., 2004; Morgan et al., 2002), and financial incentives (Hallman, 2005), all of which have met with varying degrees of limited success. Many of these studies indicated that issues beyond those of knowledge, awareness, or cost of ROPS were behind farmers’ resistance to adopting this safety measure. As Murphy (2003) states in his book *Looking Beneath the Surface of Agricultural Safety and Health*, there is “considerable incongruence and large disconnects between farm people’s safety knowledge, values, and practices.” Murphy refers to these gaps as “the farm safety-risk paradox.”

In order to create rollover prevention programs that truly motivate farmers to act, there is a need to better understand these “disconnects” by delving further into the farming community’s perceptions of risk and perceived barriers to retrofitting. As stated in a National Institute for Occupational Safety and Health (NIOSH) publication on tractor safety initiatives: “It is essential to both better understand why people resist practices that literally save their lives, and then to devise the means to overcome this resistance” (NIOSH, 2004).

In order to explore this gap between awareness and action, a survey was developed to assess farmers’ risk perceptions, as well as perceived barriers and motivators to action, using a social marketing frame of reference. Social marketing strategies have been used to address issues such as smoking (Lowry et al., 2004), helmet usage (Ludwig et al., 2005), and seat belt usage (Cohn et al., 2002) with promising success. These strategies analyze motivators and barriers connected with targeted behaviors to develop programs that: (1) make adopting the desired behavior easier, and (2) make the option of choosing this behavior more appealing (Prochaska et al., 1992; Andreason, 1995).

For the purpose of laying the foundation for a successful social marketing campaign, researchers decided it was necessary to first assess the New York farming community’s degree of readiness to retrofit tractors currently lacking ROPS. The first step in this assessment involved determining whether the “degree of readiness” differed according to various demographic characteristics. The next step was to gather qualitative information on issues involved in retrofitting from the farmer’s perspective. The first two assessments are described elsewhere (May et al., 2006). The purpose of this study is to analyze the frequency and nature of farmers’ stated opinions on various aspects of ROPS retrofitting. The strategy would then be to target those issues most salient to farmers for retrofitting for the purpose of moving them closer to the desired behavior change.

A random sample of 465 New York farms was surveyed. Results indicated that most farmers (82% of those surveyed) are aware of the dangers of tractor rollovers and the effectiveness of ROPS in preventing fatalities. However, 83% of the 465 say they have
not considered the possibility of retrofitting their tractors currently lacking a ROPS. The current analysis focuses on responses to questions in the survey that are related to perceptions of risk as well as motivators and barriers to action. It is hoped that a better understanding of farmers’ perceptions and opinions will allow researchers to remove perceived barriers to action, provide more supports that motivate farmers to action, or change the perceptions themselves to make fatalities an unacceptable consequence of farming.

Methods

Telephone surveys were conducted over two months among a random sample of New York farmers. Participants were selected from a database of farms generated from commodity association membership lists and a list from the New York State Department of Agriculture and Markets’ Agricultural Statistical Service (NASS-NY). A random sample of farms was selected within each commodity strata (livestock, dairy, cash crop, fruit, vegetable, and organic) with the goal of recruiting a roughly equivalent number of surveys for each (450 total). This method was chosen to ensure that each stratum had a large enough sample to permit between-strata comparisons for the quantitative questions contained in the survey. Thus, weighting of the sample would be required in order for any overall estimate to be representative of all New York farmers.

To offer farms the option to participate, each selected farm received two daytime, two afternoon, two nighttime, and one weekend phone call. If a farm could not be contacted with this protocol, it was classified as a non-responder and replaced with another selected farm until the desired number of participants was obtained. The survey response rate was 87%. After receiving informed consent, the questionnaire took five to seven minutes to complete with no identifiers being collected from participants.

Responses were entered into an ACCESS database for analysis. The subject’s overall risk perception was assessed with the following question: “How important do you believe it is to have rollover protection on your tractors?” A modified Likert scale was used for responses with the following options: “not at all important,” “not very important,” “important,” and “very important.” These responses were dichotomized into not important (not at all important, not very important) and important (important, very important).

A follow-up question asked respondents to elaborate on the overall risk question: “Why do you believe rollover protection is (whatever answer respondent indicated in the first question)?” Responses to this question were open-ended and were used for qualitative analysis of perceptions of risk.

Motivators and barriers to retrofitting were assessed in a similar fashion. Respondents were first asked: “Have you ever thought about installing rollover protective structures on any of your tractors that do not currently have one?” Respondents indicated either “yes” or “no.” All respondents answering “yes” were classified as having considered retrofitting, and all “no” responses were classified as having not considered retrofitting.

Respondents were then asked either of the following questions based on their response to the preceding question: “If yes, what influenced you to consider purchasing a rollover protection structure?” or “If no, why have you not considered it?” Subjects also responded to this second question in an open-ended format.

The dichotomous responses to the questions (“How important do you believe it is to have rollover protection on your tractors?” and “Have you ever thought about installing rollover protective structures on any of your tractors that do not currently have one?”) were compared between commodity groups using chi-squared ($\chi^2$) analysis.
For the two open-ended questions, telephone surveyors recorded responses verbatim without prompting or paraphrasing. One researcher then coded the major idea expressed in the farmers’ free-text responses, while a second researcher coded these same responses independently. Differences between the two researchers’ coding selections were then identified and discussed by both coders until agreement was reached.

Response percentages for open-ended questions were calculated by counting up codes and comparing them to the overall number of responses given to a particular question. The purpose of this qualitative analysis technique was to assess whether predominant themes were markedly different between commodities and to assess which issues might serve as points of departure for more in-depth qualitative analysis. For this reason, statistical comparisons were not considered applicable to analyzing qualitative themes.

A “doer/non-doer” qualitative analysis was also carried out to assess possible differences in motivators between these two groups. The “doer” category consisted of farmers who had retrofitted at least one tractor with a ROPS, and “non-doers” were farmers who thought ROPS were important and had considered retrofitting, but had not actually followed through. Frequencies of responses to the question: “What influenced you to consider purchasing a rollover protective structure?” were compared between both groups.

## Results

A total of 644 New York farmers were contacted by telephone. Of these, 562 (87%) agreed to participate in the phone survey. Subsequently, 97 farms were ineligible because all tractors had ROPS and none of them had been retrofitted. This left a total of 465 farmers to be included in the final analysis. Characteristics of this group are listed in table 1.

### Risk Perceptions

Table 2 depicts a count and frequencies of response codes for farmers who felt that ROPS were “not at all important” or “not very important.”

<table>
<thead>
<tr>
<th>Tractors</th>
<th>No.</th>
<th>Age [a]</th>
<th>Acres[a]</th>
<th>No.of Live-stock[a]</th>
<th>Tractor Hours[a][b]</th>
<th>Percent with Youth on Tractors[a]</th>
<th>Total</th>
<th>Non-ROPS Total</th>
<th>No. per Farm[a]</th>
<th>Non-ROPS per Farm[a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>All farmers</td>
<td>465</td>
<td>54.3</td>
<td>--</td>
<td>--</td>
<td>2222.8</td>
<td>19.4</td>
<td>2826</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Dairy</td>
<td>82</td>
<td>50.4</td>
<td>--</td>
<td>328.4</td>
<td>3321.9</td>
<td>17.6</td>
<td>527</td>
<td>227</td>
<td>6.4</td>
<td>2.8</td>
</tr>
<tr>
<td>Livestock</td>
<td>95</td>
<td>55.3</td>
<td>--</td>
<td>110.9</td>
<td>793.8</td>
<td>20.4</td>
<td>320</td>
<td>227</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Cash crop</td>
<td>88</td>
<td>61.6</td>
<td>211.6</td>
<td>--</td>
<td>539.2</td>
<td>18.9</td>
<td>292</td>
<td>207</td>
<td>3.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Fruit</td>
<td>74</td>
<td>54.8</td>
<td>194.3</td>
<td>--</td>
<td>2734</td>
<td>15.9</td>
<td>567</td>
<td>335</td>
<td>7.7</td>
<td>4.5</td>
</tr>
<tr>
<td>Vegetable</td>
<td>77</td>
<td>50.3</td>
<td>667.3</td>
<td>--</td>
<td>5055.2</td>
<td>16.6</td>
<td>951</td>
<td>422</td>
<td>12.4</td>
<td>5.5</td>
</tr>
<tr>
<td>Organic</td>
<td>49</td>
<td>50.8</td>
<td>70.3</td>
<td>--</td>
<td>694.2</td>
<td>10.5</td>
<td>169</td>
<td>110</td>
<td>3.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>

[a] Mean value listed.
[b] Annual hours of tractor usage for all tractors combined.
Of the 465 respondents in the survey, 85 (18%) said they believed that rollover protection on tractors was “not at all important” or “not very important.” Chi-squared analysis revealed that this proportion differed significantly across commodity strata (p < 0.0001). As shown in figure 1, this belief was most commonly held among cash crop farmers (32%) and least commonly held among dairy farmers (2%).

The reason most often given for the opinion that a ROPS was unimportant (44%) was that the topography of the respondent’s land (i.e., flat vs. hilly) made having one unnecessary (table 2). An additional 25% of farmers stated that caution, years of experience, and mindfulness of safety issues all precluded their need for a ROPS.

There was some variability in these themes across commodity strata. For both livestock farmers (45%) and cash crop farmers (28%), experience, attention, and care was the most commonly cited reason for the belief that a ROPS was unimportant. Topography (36%) was also cited quite commonly as a ROPS disincentive within the livestock stratum. While most fruit farmers who stated that ROPS were unimportant cited flat land as the reason (53%), it is noteworthy that a substantial proportion of fruit growers (29%) stated that a ROPS makes their work difficult.

Table 3 depicts a count and frequencies of response codes for farmers who indicated that they felt a ROPS was “important” or “very important.”

![Image of Figure 1](image-url)

Figure 1. Percentage of New York farmers who consider ROPS important/not important.
Table 3. Why do you believe a ROPS is important or very important?

<table>
<thead>
<tr>
<th>Why Important?</th>
<th>Total</th>
<th>Livestock</th>
<th>Dairy</th>
<th>Cash Crop</th>
<th>Fruit</th>
<th>Vegetable</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experienced a rollover</td>
<td>3% (10)</td>
<td>2% (2)</td>
<td>4% (3)</td>
<td>2% (1)</td>
<td>2% (1)</td>
<td>5% (3)</td>
<td>--</td>
</tr>
<tr>
<td>General safety</td>
<td>63% (241)</td>
<td>61% (51)</td>
<td>72% (57)</td>
<td>63% (40)</td>
<td>50% (28)</td>
<td>72% (44)</td>
<td>55% (21)</td>
</tr>
<tr>
<td>Have ditches</td>
<td>0% (1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2% (1)</td>
<td>--</td>
</tr>
<tr>
<td>Have hills</td>
<td>8% (32)</td>
<td>10% (8)</td>
<td>9% (7)</td>
<td>10% (6)</td>
<td>5% (3)</td>
<td>3% (2)</td>
<td>16% (6)</td>
</tr>
<tr>
<td>Heard rollover stories</td>
<td>2% (8)</td>
<td>2% (2)</td>
<td>4% (3)</td>
<td>2% (1)</td>
<td>2% (1)</td>
<td>--</td>
<td>3% (1)</td>
</tr>
<tr>
<td>Personal acquaintance killed</td>
<td>3% (10)</td>
<td>6% (5)</td>
<td>3% (2)</td>
<td>--</td>
<td>--</td>
<td>2% (1)</td>
<td>5% (2)</td>
</tr>
<tr>
<td>Personal acquaintance injured</td>
<td>2% (6)</td>
<td>1% (1)</td>
<td>--</td>
<td>5% (3)</td>
<td>--</td>
<td>2% (1)</td>
<td>3% (1)</td>
</tr>
<tr>
<td>Worker safety</td>
<td>3% (13)</td>
<td>4% (3)</td>
<td>1% (1)</td>
<td>--</td>
<td>9% (5)</td>
<td>5% (3)</td>
<td>3% (1)</td>
</tr>
<tr>
<td>Child safety</td>
<td>1% (2)</td>
<td>--</td>
<td>--</td>
<td>2% (1)</td>
<td>2% (1)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Not applicable[a]</td>
<td>15% (57)</td>
<td>13% (11)</td>
<td>8% (6)</td>
<td>17% (11)</td>
<td>30% (17)</td>
<td>10% (6)</td>
<td>16% (6)</td>
</tr>
<tr>
<td>Total</td>
<td>380</td>
<td>22% (83)</td>
<td>21% (79)</td>
<td>17% (63)</td>
<td>15% (56)</td>
<td>16% (61)</td>
<td>10% (38)</td>
</tr>
</tbody>
</table>

[a] Indicates that the farmer’s response was unrelated to the question.

Three hundred eighty (82%) respondents believed ROPS were “important” or “very important.” Of these, 241 (63%) cited general safety reasons as their primary concern (i.e., avoiding fatalities, keeping the driver safe, etc.). This reason was most commonly cited within the individual commodity strata, as well. Topography was also a popularly cited reason indicating a need for ROPS (i.e., for 10% of livestock farms, 9% of dairy farms, and 16% of organic farms).

Motivators to Retrofitting

Table 4 depicts a count and frequencies of response codes for farmers who indicated that they had given thought to or followed through on the installation of a ROPS on one or more of their tractors without ROPS.

Seventeen percent (79) of the surveyed farmers indicated they had given thought to installing a ROPS on their tractors that did not currently have one. Chi-squared analysis of these proportions revealed significant differences across commodity strata (p < 0.03). As shown in figure 2, approximately twice the number of livestock farmers (30%) had considered purchasing a ROPS, when compared to farmers specializing in other commodities.

Table 4. What influenced you to consider purchasing a ROPS?

<table>
<thead>
<tr>
<th>Influences</th>
<th>Total</th>
<th>Livestock</th>
<th>Dairy</th>
<th>Cash Crop</th>
<th>Fruit</th>
<th>Vegetable</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child safety</td>
<td>4% (3)</td>
<td>4% (1)</td>
<td>--</td>
<td>14% (1)</td>
<td>--</td>
<td>--</td>
<td>11% (1)</td>
</tr>
<tr>
<td>Dealer or program incentive</td>
<td>5% (4)</td>
<td>4% (1)</td>
<td>8% (1)</td>
<td>--</td>
<td>15% (2)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>General safety</td>
<td>45% (36)</td>
<td>52% (14)</td>
<td>58% (7)</td>
<td>43% (3)</td>
<td>31% (4)</td>
<td>45% (5)</td>
<td>33% (3)</td>
</tr>
<tr>
<td>Dangerous job task</td>
<td>9% (7)</td>
<td>7% (2)</td>
<td>8% (1)</td>
<td>--</td>
<td>8% (1)</td>
<td>18% (2)</td>
<td>11% (1)</td>
</tr>
<tr>
<td>News of accidents</td>
<td>4% (3)</td>
<td>--</td>
<td>8% (1)</td>
<td>--</td>
<td>8% (1)</td>
<td>11% (1)</td>
<td>--</td>
</tr>
<tr>
<td>Rollover death of someone they knew</td>
<td>3% (2)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>8% (1)</td>
<td>9% (1)</td>
<td>--</td>
</tr>
<tr>
<td>Worker safety</td>
<td>1% (1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>9% (1)</td>
<td>--</td>
</tr>
<tr>
<td>Not applicable[a]</td>
<td>29% (23)</td>
<td>33% (9)</td>
<td>17% (2)</td>
<td>43% (3)</td>
<td>31% (4)</td>
<td>18% (2)</td>
<td>33% (3)</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>34% (27)</td>
<td>15% (12)</td>
<td>9% (7)</td>
<td>16% (13)</td>
<td>14% (11)</td>
<td>11% (9)</td>
</tr>
</tbody>
</table>

[a] Indicates that farmer’s response was unrelated to the question.
Figure 2. Percentage of New York farmers who have/have not considered retrofitting.

A large proportion of those who had considered purchasing a ROPS (45%) indicated general concerns about safety (e.g., “because it can save your life,” “for the safety of my family”) as an important motivational factor (table 4). Others indicated that the necessity of performing unsafe tasks (9%) or concerns about child safety (4%) was a motivating factor. For fruit farmers, dealer/program incentives (15%) were cited more commonly as a motivating factor than in any other commodity stratum.

**Barriers to Retrofitting**

Table 5 depicts a count and frequencies of response codes for farmers indicating they had not considered a ROPS retrofit for any of their tractors.

Eighty-two percent (380) of those surveyed indicated they had not considered a ROPS retrofit. The most prominent barrier cited by many respondents (40%) was that “they didn’t feel it (ROPS) was necessary.” Factors such as flat land, minimal use of tractors without ROPS, use of tractors with ROPS for dangerous tasks, caution, experience, awareness of safety issues, and tractor design were all listed as reasons for this belief.

<table>
<thead>
<tr>
<th>Why Not?</th>
<th>Total</th>
<th>Livestock</th>
<th>Dairy</th>
<th>Cash Crop</th>
<th>Fruit</th>
<th>Vegetable</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor age</td>
<td>12% (47)</td>
<td>19% (12)</td>
<td>12% (8)</td>
<td>14% (13)</td>
<td>7% (4)</td>
<td>13% (8)</td>
<td>5% (2)</td>
</tr>
<tr>
<td>Won’t fit in barn</td>
<td>3% (10)</td>
<td>2% (1)</td>
<td>8% (5)</td>
<td>2% (2)</td>
<td>5% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>19% (73)</td>
<td>33% (21)</td>
<td>32% (21)</td>
<td>8% (7)</td>
<td>5% (3)</td>
<td>18% (11)</td>
<td>26% (10)</td>
</tr>
<tr>
<td>Not necessary</td>
<td>40% (151)</td>
<td>22% (14)</td>
<td>35% (23)</td>
<td>41% (37)</td>
<td>49% (28)</td>
<td>50% (31)</td>
<td>46% (18)</td>
</tr>
<tr>
<td>Don’t like them</td>
<td>0% (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t know how</td>
<td>1% (2)</td>
<td>2% (1)</td>
<td></td>
<td></td>
<td>2% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never thought about it</td>
<td>2% (8)</td>
<td>3% (2)</td>
<td>3% (2)</td>
<td>2% (2)</td>
<td></td>
<td></td>
<td>5% (2)</td>
</tr>
<tr>
<td>Only used by farmer</td>
<td>2% (8)</td>
<td>5% (3)</td>
<td>3% (2)</td>
<td>1% (1)</td>
<td>2% (1)</td>
<td></td>
<td>3% (1)</td>
</tr>
<tr>
<td>Tractor won’t accommodate ROPS</td>
<td>4% (14)</td>
<td>8% (5)</td>
<td>3% (2)</td>
<td>1% (1)</td>
<td></td>
<td>6% (4)</td>
<td>5% (2)</td>
</tr>
<tr>
<td>Rented tractor</td>
<td>0% (1)</td>
<td>2% (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show tractor</td>
<td>1% (2)</td>
<td></td>
<td>2% (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will buy newer tractors</td>
<td>2% (9)</td>
<td></td>
<td>2% (1)</td>
<td>4% (4)</td>
<td>7% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>They get in the way</td>
<td>5% (18)</td>
<td></td>
<td>2% (2)</td>
<td>28% (16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hassle</td>
<td>0% (1)</td>
<td></td>
<td></td>
<td>1% (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable[a]</td>
<td>9% (35)</td>
<td>6% (4)</td>
<td>2% (1)</td>
<td>23% (21)</td>
<td>2% (1)</td>
<td>11% (7)</td>
<td>3% (1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>380</td>
<td>17% (64)</td>
<td>18% (66)</td>
<td>24% (91)</td>
<td>15% (58)</td>
<td>16% (62)</td>
<td>10% (39)</td>
</tr>
</tbody>
</table>

[a] Indicates that the farmer’s response was unrelated to the question.
“Cost” (19%) and “age of tractor” (12%) were also frequently cited barriers to considering a ROPS purchase when looking at all strata combined. A variety of these responses indicated that farmers consider retrofitting an old tractor as not “cost-effective.” These trends are reflected in each stratum, as well, with a few exceptions (e.g., “cost” was more of a barrier for livestock farmers, while design issues, “they get in the way,” was a prevalent issue for fruit farmers).

**Doer/Non-Doer Analysis**

Researchers compared the frequencies of coded responses between doers (those who had retrofitted) and non-doers (those who thought ROPS were important and had considered purchasing but had not actually followed through). The purpose of this comparison was to assess whether motivators to action were different between these two groups. For this reason, coded responses to the question “What influenced you to consider purchasing a ROPS?” were compared for doers and non-doers (table 6).

Doers and non-doers were similar with regard to motivators, with general safety concerns being their primary motivators to considering a ROPS purchase. However, twice as many doers indicated that the necessity of performing dangerous tasks triggered consideration of retrofitting.

**Discussion**

**Risk Perceptions**

The farmer responses in our survey indicate that a general knowledge of ROPS and the danger of tractor rollovers is not lacking in the farming community. Many farmers (82%) believed that ROPS are generally a good safety feature to have on their tractors, due to a concern for safe tractor operation. What is interesting is that so few (17%) had actually considered retrofitting, lending credence to the statement by Murphy (2003) that there is a vast difference between what farmers know and what farmers do (the farm safety-risk paradox). Even when farmers indicated that a ROPS was not important, there appeared to be some knowledge of the safety risks of operating tractors without one. This is most likely related to the belief that their particular circumstances (flat land, experience, or knowledge of the dangers) afford them protections that make ROPS unnecessary. This belief in the susceptibility of others and not oneself to a particular hazard is described by Weinstein (1988) as the “precaution adoption process.” Weinstein discusses three stages an individual must go through in order to take on a particular safety behavior. In stage 1, the individual has heard of the hazard. In stage 2, the individual believes in the likelihood of the hazard for others, but not for himself. In stage 3, the

<table>
<thead>
<tr>
<th>What influenced you?</th>
<th>Non-doers</th>
<th>Doers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dealer incentive or program incentives</td>
<td>5% (3)</td>
<td>5% (1)</td>
</tr>
<tr>
<td>General safety concerns</td>
<td>47% (27)</td>
<td>35% (8)</td>
</tr>
<tr>
<td>Necessary due to dangerous job task</td>
<td>7% (4)</td>
<td>18% (4)</td>
</tr>
<tr>
<td>Rollover death or accident involving someone they knew</td>
<td>2% (1)</td>
<td>5% (1)</td>
</tr>
<tr>
<td>Worker safety</td>
<td>3% (2)</td>
<td>--</td>
</tr>
<tr>
<td>Concerned about child safety</td>
<td>5% (3)</td>
<td>--</td>
</tr>
<tr>
<td>News coverage of accidents</td>
<td>5% (3)</td>
<td>--</td>
</tr>
<tr>
<td>Not applicable[a]</td>
<td>26% (15)</td>
<td>36% (8)</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>22</td>
</tr>
</tbody>
</table>

[a] Indicates that the farmers’ responses were unrelated to the question.
individual acknowledges personal susceptibility. Results from our survey indicate that many New York farmers are in stage 2, believing that rollovers can occur, but not to them personally.

It is also interesting to note the variance in risk perception in the different commodity strata. For example, one-third of cash crop farmers appear unconvinced of the need for a ROPS (one-third of respondents indicating that a ROPS was “not at all” or “not very important”), while only 2% of dairy farmers felt similarly. It is difficult to say whether this is due to differences in risk exposures (hilly vs. flat terrain, several employees vs. none) or whether cash crop farmers lag in their understanding of the risks associated with tractor operation. Perhaps further exploration of this phenomenon in interviews or focus groups is necessary.

Barriers and Motivators to Retrofitting

The discrepancy between the relatively large number of respondents who see the benefits of ROPS and the relatively small number who have considered retrofitting may indicate that proper motivators are currently lacking or that the existing barriers are significant enough to prevent serious consideration of acting.

Responses from our survey indicate that a more careful exploration of motivators is necessary. The motivators discussed by respondents in this survey who had considered the purchase of a ROPS (e.g., “general safety concerns”) were rather vague. Comments such as: “because it (ROPS) can save your life,” “it is dangerous not to have one (ROPS),” and “they’re (ROPS) a good idea for safety” are not specific enough to allow constructive analysis of how to get farmers to consider this safety measure. It is clear that subtle distinctions in this category exist and further exploration in qualitative interviews would be necessary to get a deeper understanding of what is behind these concerns and which of these concerns actually lead to action.

Several farmers who cited safety concerns specifically indicated that the protective features of cabs were what they found appealing (e.g., protecting from sun exposure, chemicals, or other undesirable elements). Perhaps marketing features that more immediately appeal to farmers’ sensibilities, or designing a ROPS with features that provide more immediate rewards, would be good targets for interventions.

Another motivator mentioned by those who had considered retrofitting was the necessity of performing dangerous job tasks, although these tasks were not explicitly stated. This possibly lends credence to the theory that farmers have their own internal process of calculating risk and act accordingly. If they feel the job warrants protection, they may be more willing to follow through.

Fruit farmers indicated that dealer/program incentives were persuasive, but the sample size was relatively small, and it is difficult to say conclusively whether this would be an effective motivator for this group.

Few farmers indicated that news coverage of a rollover fatality or the injury or death of a personal acquaintance was a motivator. Of course, it is possible that several farmers citing general safety concerns could have been influenced by knowledge of rollover tragedies, but as stated previously, this seems to indicate that a more thorough exploration of general safety concerns is necessary.

Many of the 378 (39%) farmers who had not considered retrofitting said that they felt it was unnecessary. As discussed previously, this appears to contradict the general acknowledgement that ROPS are an important safety feature and also indicates that many New York farmers do not perceive personal susceptibility to rollovers. In addition, several of these farmers stated that they used tractors without ROPS for less dangerous work (i.e., primarily using tractors on flat land, using their tractors with ROPS for dangerous tasks, and rarely using tractors without ROPS). This indicates that some
farmers strategize and use more convenient, less costly alternatives, which they believe keep them safe and allow them to operate tractors with less fear of injury.

Cost and age of tractor were also barriers to action that were cited by respondents (although infrequently), as was a propensity for a ROPS to interfere with work (fruit farmers). Further exploration of financial issues in qualitative interviews would be helpful, as previous research among New York farmers indicates that financial issues are complicated and may indeed be farmers’ reactive response to retrofitting (Hallman, 2005).

For fruit farmers, engineering solutions may prove most successful in convincing them to take the step of retrofitting, since responses indicate the cabs or rollover bars either damage tree branches or add difficulty to moving through rows of trees and grapes in orchards and vineyards.

Although the results of this survey provide an interesting look into the relative importance that New York farmers ascribe to ROPS and the factors that influence decisions to retrofit, the study has limitations worth mentioning. Participants were randomly sampled from agriculture member association lists and information provided from NASS-NY. It is possible that these lists may contain farms that are not representative of farmers in the state as a whole. Additionally, the nature of the survey required brief responses, making in-depth analysis of attitudes or beliefs impossible. Perceptions of safety about ROPS are complex and difficult to impart in a one- to two-sentence response. However, since the study was designed to be a preliminary step to more detailed analyses, this weakness may eventually be addressed in subsequent research. Furthermore, the limited numbers of responses in some cells make comparisons inconclusive and may indicate areas that require further exploration in qualitative interviews.

Although the responses are brief, a fairly large number of responses are available for analysis and are perhaps more representative of New York farming perspectives than in-depth interviews or focus groups. In addition, few preliminary analyses have been published on attitudes or perceptions that could strongly influence or help in the design of social marketing campaigns or at least lend an inside perspective on the factors that influence farmers’ decisions to retrofit. Furthermore, the results of the quantitative part of our survey are validated by three separate studies done in the 1990s, all of which involved visual inspection of tractors (Hallman et al., 1997; Hill et al., 1992; West and May, 1998) and which lead us to believe that the responses gathered in this survey may address the issues of selection bias previously mentioned.

Conclusions and Recommendations

As stated previously, the object of a social marketing campaign is to remove barriers to action and to enhance motivators, in order to move an individual closer to a desired behavior. The responses given to the open-ended questions in this survey indicate fruitful points of departure for further qualitative inquiry. The data generated will then be used to design retrofit programs that confront the actual barriers preventing farmers from retrofitting (i.e., cost, ROPS design issues, and other factors), as well as the perceived barriers (i.e., “don’t think it’s necessary,” “don’t think it’s cost-effective for older tractors,” etc.). It will also involve a more in-depth exploration of what “general safety concerns” motivate farmers and what incentive packages can be designed that will make the process easier once an individual has decided to take the initial step.

Most importantly, the responses given to these survey questions indicate that a necessary component of any social marketing campaign will be to convince farmers that they are personally susceptible to rollovers and that ROPS are a necessary safety feature
for anyone driving a tractor (experienced or inexperienced, careful or not careful), regardless of circumstances. Such a campaign will also need to emphasize the point that the financial and emotional issues that accompany rollover fatalities are often devastating enough to cause loss of the farm (NIOSH, 2004), in the end making purchase of a ROPS, even for an old tractor, “cost-effective.”

Results from the survey also indicate that perceptions of risk and motivators and barriers to action differ slightly between commodity strata (e.g., cost appears to be more of an issue for livestock farmers, while design issues are more salient for fruit farmers). These differences indicate that messages and programs designed to motivate farmers may need to be tailored to the concerns of the different commodity segments, in order to create real change.

As well as exploring the themes generated from the questions in this initial survey, formative research for an effective social marketing campaign will also require an exploration of how to present messages most effectively (i.e., which messages are most persuasive, and in what context are farmers most receptive to safety messages) and how to make retrofits and the process of retrofitting more appealing to farmers (i.e., improving the product).

Acknowledgements

This project was made possible through the generous funding of a grant by NIOSH (National Institute of Occupational Safety and Health Cooperative Agreement No. U50 OH007542 – The Northeast Center for Agricultural Health), the guidance of the Mary Imogene Bassett Hospital Institutional Review Board, the collaboration of the New York State Department of Agriculture and Markets’ Agricultural Statistical Service, the Academy for Educational Development in Washington, D.C., the various New York agricultural associations, and, most importantly, the time and assistance given by many of New York State’s farmers, to whom we are very grateful.

References


Preventing Tractor Overturn Injuries:  
The New York ROPS Retrofit Social Marketing Intervention

The Challenge:  
About one-third of fatalities in the agricultural sector result from tractor overturns, yet rollbars on tractors can minimize and prevent overturn injuries. Rollbars (also called Roll-over Protective Structures or ROPS) have been standard on tractors manufactured in the U.S. since 1985, but many older tractors without ROPS are still being used daily. Cost and cultural factors present barriers to retrofitting these older tractors.

Impact:  
In the six months following the NIOSH-funded Northeast Center for Agricultural and Occupational Health’s (NEC) social marketing intervention, tractor dealers in the 5 targeted counties sold approximately ten times more rollbars than in the six months prior to the intervention. They also sold roughly eight times as many retrofits as dealers in comparison counties. 40% of farmers who received rebates, however, bought their rollbars directly from the manufacturer, making the dealer numbers a conservative estimate of the intervention’s impact.

To learn more about how they did it and what you can do in your community, please see our resources on the back.
Approach:
Researchers at NEC studied risk perceptions, barriers, and motivating factors to tractor retrofitting among farmers in New York State. The results guided a social marketing campaign that was rigorously evaluated by implementing different levels of intervention efforts around New York and Pennsylvania and then comparing retrofit sales across different campaign regions.

Results:
NEC’s campaign included a hotline to make retrofitting more convenient and multimedia communications that emphasized advantages of retrofitting. Farmers were offered a 70% rebate on the cost of the rollbar, funded by the New York State Legislature. In the first year, more than 1000 farmers expressed interest, 259 completed the retrofit/rebate process, 80 additional rebates were designated and another 404 were being processed pending additional funding.

Useful Resources
New York State ROPS Retrofit Program
www.ropsr4u.com
Northeast Center for Agricultural and Occupational Health
www.ncamh.com
NIOSH InSights Web Library
www.cdc.gov/niosh/programs/ad/pub.html
NIOSH NORA Sector Web Page
www.cdc.gov/niosh/nora/councils/agff
NIOSH Home Page
www.cdc.gov/niosh

NIOSH Contact Information
To receive NIOSH documents or more information about occupational safety and health topics, contact NIOSH at
1-800-cdc-info (1-800-232-4636)
1-888-232-6348 (tty)
email: cdcinfo@cdc.gov
July, 2008