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An All-Terrain Vehicle Safety Educational Program: Is It Effective in Improving Attitudes, Safety Knowledge, and Behaviors in Adolescents Ages 12 to 18?

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AN ALL-TERRAIN VEHICLE SAFETY EDUCATIONAL PROGRAM: IS IT EFFECTIVE IN IMPROVING SAFETY KNOWLEDGE, ATTITUDES AND BEHAVIORS IN ADOLESCENTS AGES 12 TO 18?

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Abstract

All terrain vehicles (ATVs) are a popular source of recreation. For some rural adolescents, ATVs are frequently used for agricultural work. Whether for work or recreation, many adolescents operate ATVs improperly either from a lack of knowledge, poor judgment or they engage in risky behaviors resulting in injuries and fatalities.

The Kentucky Department of Agriculture (KDA) has devoted resources to provide ATV safety programs to educate adolescents statewide. However, there are no known studies evaluating the effectiveness of this KDA intervention. Therefore, a pilot study was proposed to determine the effectiveness of The KDA ATV safety program in improving ATV safety knowledge, attitudes and behaviors of adolescents ages 12 to 18.

Following HSRB approval, a pre-experimental one group, pre-test, post-test design pilot study was conducted. A convenience sample (n=18) was drawn from adolescents registered to attend an ATV safety program provided by the KDA. The study was conducted in a south central Kentucky city.

Haddon's Matrix was used as the theoretical framework using the dual axis approach to injury prevention and injury control. On one axis are the host, the agent and the environment. In this study the host is the adolescent ATV driver, and the agent is the

all-terrain vehicle. The environment includes the terrain, applicable ATV laws and societal attitudes toward ATV safety. On the second axis are the pre-event, event and post-event phases. Haddon's Matrix is a process mechanism in which opportunities to reduce ATV related injuries and fatalities can be identified. It is believed that knowledge, attitudes and behaviors regarding ATV safety can be positively influenced through effective educational strategies, ATV engineering design changes and ATV law enforcement issues as identified through the use of Haddon's Matrix.

Descriptive statistics and paired ***t***-tests were used to analyze the data. The analysis revealed no statistically significant changes in adolescent knowledge following the intervention. However, there were statistically significant improvements in ATV related safety attitudes and behaviors. In conclusion, efforts should continue to prevent ATV-related injuries and fatalities via educational strategies to change behaviors and attitudes regarding ATV safety in communities and individuals. Implications include the need for further research to determine best practice ATV educational strategies that create positive change.

Chapter I

Introduction

According to the National Safety Council (NSC), all- terrain vehicles (ATVs) have been used for work and pleasure on many farms and ranches across the nation since the early 1970's (National Safety Council, 2004). Designed for off road use on various terrains, ATVs then were motorized vehicles capable of speeds in excess of 50 miles per hour (Adams, Medeiros, Dereska, & Hawkins, 2004). Other design details of an ATV included three or four large tires, with a high center of gravity. In the 1970's and early 1980's, increased popularity and use of ATVs resulted in a disturbing increase in injuries and mortality (Fonseca, Ochsner, Bromberg, & Gantt, 2005). Subsequent to the surge in ATV-related injuries and fatalities in the 1970's and 1980's, media attention increased awareness and sparked public outcry that led many state legislatures to pass laws addressing this public health concern.

Between 1988 and 1998, a 10-year consent decree was established between ATV manufacturers and the Consumer Product Safety Commission (Natural Trails and Waters Coalition, 2003). Under the decree, ATV manufacturers agreed to no longer sell the three-wheeled ATV due to its very unstable design. Counterintuitive to public health and safety, there was no recall of the 3-wheeled ATVs and they continue to be in use today. As part of the decree, manufacturers agreed to develop ATV safety training programs and agreed to develop engineering features to improve the safety of ATVs. In response, ATV manufacturers created ATVs with two smaller engine sizes (70 cubic centimeters and 90

cubic centimeters displacement respectively) and developed age restrictions applicable to the engine sizes. During this 10 year period there was a reduction in injuries related to ATV use.

Significance of the Problem

According to the United States Consumer Product Safety Commission (CPCS, 2007), there were 93,600 individuals treated in emergency departments (ED) nationwide for ATV-related injuries in 1987, one year prior to activation of the decree. In 1988, 74,600 ATV-related ED visits were recorded by the CPCS. By 1997, one year before the decree expired, the number had fallen to 52,800 ATV-related ED visits. Since the decree expired in 1998, a dramatic increase in ATV related injuries has occurred as evidenced by the 2005 CPCS report where 136,700 ED visits were attributed to ATV-related injuries. Overall, ATV-related injuries and fatalities resulted in expenditures of $11.4 billion dollars in 2003 (Emergency Nurses Association, 2006).

Since the decree expired in 1998, sales of ATVs have soared. All terrain vehicles are now bigger with the weight of the average adult sized ATVs weighing more than 550 pounds and many engines exceeding 400 cubic centimeters displacement (Natural Trails and Waters Coalition, 2003). They are also faster and factory equipped to trek across terrains at 75 miles per hour (Natural Trails and Waters Coalition, n.d.).

Many adolescents operate ATV improperly either from a lack of knowledge, poor judgment or by engaging in risky behaviors (North American Guidelines for Children's Agricultural Tasks, n. d.). Children under the age of 16 are at highest risk for ATV-related injuries (American Academy of Pediatrics, 2000). According to the American

Academy of Orthopedic Surgeons, children in this age group experienced nearly 40 percent of all ATV-related injuries and fatalities in the year 2000 (American Academy of Orthopaedic Surgeons, 2002). Unfortunately, between 2003 and 2006, Kentucky has had more ATV-related fatalities in children under the age of 21 than any other state (Kentucky Office of Highway Safety, n. d.).

On July 25, 2005, Dr. Roger Humphries, Associate Professor, Chair, Department of Emergency Medicine, University of Kentucky College of Medicine testified to the Interim Joint Committee on Health and Welfare. He stated that there were 3.91 million ATVs in use and 5.89 million drivers nationally with 60% of the drivers living in rural areas. Dr. Humphries also testified that children under the age of 16 are most at risk when driving ATVs. Reasons he cited as risk factors for children include: 1) immature psychomotor skills and strength, 2) lack of cognitive development to operate ATVs safely on a consistent basis, 3) inappropriate risk-taking, 4) use of adult sized ATVs, and 5) ignored engine, age and passenger restrictions as designated by the manufacturer (Commonwealth of Kentucky, 2005).

Since 2002, Kentucky has led the nation in ATV-related fatalities (Kentucky Department of Agriculture, 2008). According to the Kentucky State Police (KSP), in 2007, there were 24 ATV related fatalities in Kentucky where 83 % of the victims failed to wear a helmet (Kentucky State Police, 2008). In an attempt to reduce the number of ATV-related injuries and fatalities, the Kentucky Department of Agriculture (KDA) has allocated resources to provide ATV safety education programs to educate adolescents and others statewide. In a collaborative effort the KDA and the KSP joined forces to train 18

Kentucky State Troopers in November 2007. The Kentucky State Police Troopers returned to their respective communities to teach ATV safety to individuals in the communities they serve. Together the KDA and KSP are attempting to educate the public as the KSP pledges to enforce current Kentucky laws addressing use of all-terrain vehicles.

Kentucky Agriculture Commissioner, Richie Farmer, stated he planned to approach the General Assembly to appropriate $250,000 dollars to expand the KDA ATV safety program statewide (Kentucky Department of Agriculture, 2007). Currently, Kentucky is experiencing a budget deficit and many educational resource appropriations have been reduced or eliminated making good stewardship of public funds essential. Continued allocation of resources for ATV safety programs should be evidenced-based on research examining the effectiveness of ATV safety programs in improving ATV safety knowledge, attitudes and behaviors. However, there are no known studies evaluating the efficacy of this specific intervention. Therefore, the purpose of this pilot study was to determine the effectiveness of the KDA ATV safety program in improving ATV safety knowledge, attitudes and behaviors in adolescents ages 12 to 18 in south central Kentucky.

In summary, this chapter describes the significance of the problem related to the staggering number of individuals who are injured or die annually as a result of ATV-related crashes. Resources to support ATV educational programs in Kentucky are limited;

therefore, appropriate stewardship of public funds is crucial. Prevention of ATV crashes via educational programs increases ATV safety awareness and knowledge. Replacing risky behaviors with positive changes in behaviors and attitudes will result in saved lives.

Chapter II

Review of the Literature

The literature search revealed a policy statement developed by the American Academy of Pediatrics that addressed child safety and the use of all-terrain vehicles. Guidelines created by the National Children's Center for Rural and Agricultural Health and Safety to reduce childhood injuries while using an ATV for agricultural purposes were found. Several studies that focused on the etiology, mechanism of injury, morbidity and mortality rates and outcomes of victims involved in ATV related crashes. There were a few studies that focused on the effectiveness of general farm safety educational programs and some of these programs included a small component of ATV safety. Studies focusing on the qualifications, characteristics and instructional methods of the farm safety instructors were included. There was a paucity of studies focused entirely on ATV safety educational programs and their effectiveness. Finally, the literature search revealed no studies that exclusively evaluated the effectiveness of the ATV safety program known as the Farm Safety Program – ATV Training Course provided by the Kentucky Department of Agriculture.

The American Academy of Pediatrics (2000) initially developed a policy statement in 1987 regarding ATV injury prevention and updated the policy in 2000. Outlined in the updated policy are the etiologies of injuries sustained by children as the result of ATV crashes. Recommendations developed by the American Academy of Pediatrics (AAP) include education, engineering and law enforcement strategies to reduce injuries and fatalities. Education should be directed toward children, parents and

the public regarding the potential dangers associated with ATV use. Increased parental and individual accountability was suggested. The AAP specifically endorsed that no child under the age of 16 should be allowed to operate a motorized off-road vehicle such as an ATV. The AAP recommended that all operators of ATVs should wear helmets, goggles or other eye protection and protective clothing, and to avoid carrying passengers. To increase the visibility of ATVs, the ATV should have reflectors/reflective tape, flags and headlights that remain on while the ATV is in use. Other engineering details such as seat belts, roll bars and speed governors to limit high speeds were included. Enforcement recommendations include laws that 1) require a driver's license and certification in ATV use, 2) prohibit ATV use between dusk and dawn, 3) development and maintenance of trails designed for ATV use and 4) improving pre-hospital emergency personnel training and access to rural areas.

The North American Guidelines for Children's Agricultural Tasks, (n.d.) (NAGCAT) developed by National Children's Center for Rural and Agricultural Health and Safety provide direction for adults to determine if conditions are favorable for an adolescent to operate an ATV for agricultural purposes. Adults are asked to assess: 1) the working condition of the ATV, 2) the safety of the terrain, 3) availability of appropriate sized helmet, eye protection, gloves, boots and size of the ATV, 4) the physical strength, psychomotor skills, cognitive and maturity level of the child. According to the NAGCAT guidelines, the adult's ability to properly train and supervise the child while operating an ATV is essential to injury prevention.

According to the American College of Surgeons (2002), the most commonly reported ATV related injuries include skin and orthopedic injuries followed by head and facial trauma. The next most prevalent were chest and abdominal injuries. These findings are consistent with the policy statement by the American Academy of Pediatrics (2000). Data cited in fact sheets by the American Academy of Orthopaedic Surgeons (2002), and the Emergency Nurses Association Injury Prevention Institute (2006) was in agreement. Risk factors including the age, body size, psychomotor skills, and cognitive abilities of children are important variables in safe operation of an ATV (North American Guidelines for Children's Agricultural Tasks, n. d.).

A retrospective study conducted by Bhutta, Greenberg, Fitch, & Parnell (2003), examined injury patterns in children as a result of ATV crashes and the associated prognostic implications for radiologists. The medical records of 141 consecutive patients admitted to a pediatric hospital in Arkansas between 1998 and 2001 were examined for demographic data and patient outcomes. Citing consistency with other studies, the authors noted the most common injuries from ATV crashes were orthopedic injuries followed by injuries to the central nervous system. The third most common injuries were to the torso including the chest and abdomen. An association between death and brain injury was significant, and an association between chest contusion and death or long-term disability was also demonstrated. The mean age of those injured was "…11.6 years with a standard deviation of 4.2 years" (Bhutta, *et al*., 2003). Only children admitted to the hospital were included in this study; thus, those treated and released from the emergency department and those that died prior to admission were not included.

All-terrain vehicles are a popular source of entertainment and people of all ages enjoy operating them. At least 30% of those injured are under the age of 16. One particularly vulnerable group includes individuals over the age of 60. A retrospective geriatric study conducted by Adams, Medeirios, Dereska & Hawkins (2004), concluded that all ATV operators and riders, regardless of age, should wear an appropriate helmet. Educational interventions to increase public awareness of this need were emphasized by the authors. Another recommendation was to include ATV safety training in conjunction with motor vehicle driver safety education as conducted by the American Association of Retired Persons. Specifically, this study reviewed the database at a level-one trauma center in southeast Georgia. Between 1988 and 2002, eight geriatric patients were admitted for injuries attributed to an ATV crash with 75% of the crashes occurring between 2000 and 2002. The two aims of this study were to determine if geriatric patients have different injury patterns than younger cohorts and to determine if the elderly cohort demonstrated a difference in functional outcomes in comparison to the younger cohorts. Like their younger cohorts, this population sustained traumatic brain injuries, face, neck and spinal injuries and injuries to the thorax, abdomen and extremities. This population, due to the presence of preexisting co-morbidities, had longer length of stays in the ICU and hospital and had poorer functional outcomes in comparison to the younger cohorts.

With the increased use of ATVs has come increased emergency room visits, and hospital stays due to ATV-related injuries. One retrospective study compared ATV-related injuries and deaths to motorcycle injuries and deaths. Motorcycles and ATVs are similar in the method of steering and riding and operators of both often fail to wear

helmets and other protective gear. Findings of this study concluded that individuals suffer ATV-related injury and death statistically equivalent to those individuals who are injured or die as a result of a motorcycle crash (Fonseca, Ochsner, Bromberg, & Gantt, 2005). The incidence of spinal cord and abdominal injuries between the two groups was similar. In contrast, closed head injuries occurred more frequently in the ATV group while orthopedic injuries and thoracic injuries were more common in the motorcycle group. ATV risk factors indentified included male gender, failure to wear a helmet, lack of ATV safety training and physical and cognitive immaturity to appropriately operate the ATV. Recommendations included new, stricter legislation with active enforcement of the laws as well as an increased attention to injury prevention through understanding the physical and cognitive limitations of children under the age of sixteen.

A retrospective study conducted by Humphries, Stone, Stapczynski, & Florea, (2006) accessed databases from the University of Kentucky trauma registry. Criteria included all children under the age of 18 admitted between the years 1996 to 2000 with ATV-related trauma (n=151). Costs of treatment at this facility for the 151 patients admitted during the four-year period exceeded 2.1 million dollars. This figure failed to reflect pre-hospital, transfer and post-discharge care or rehabilitation expenses. Similarly, this figure does not reflect in-patient expenses incurred in other facilities in Kentucky during the same time period. This study identified risk factors for injury and death related to ATV crashes as follows: male gender, failure to use a helmet, ATV operators less than 16 years of age, and children riding as passengers. Recommendations included safety education to emphasize the use of helmets and the need to avoid passengers on ATVs.

The authors also called for new legislation that would not allow children under the age of 16 to operate or ride on an ATV.

According to Jones & Bleeker (2005), the most frequently reported mechanism of injury to youth occurred when youth lost control of the ATV resulting in an ATV rollover and the ATV subsequently landing on the victim(s). Other injuries sustained occurred when the victim(s) fell off the ATV, the victim(s) were ejected from the ATV, or when the ATV collided with a fixed object. The authors further noted that injuries were secondary to increased ATV exposure and risk-taking behaviors. The purpose of this study was to compare exposures, and describe behaviors and injury patterns between farm youth and non-farm rural youth. In this cross-sectional study, a 148-item survey was administered to 652 youths attending agricultural education programs in the state of Arkansas in the early spring of 2000. Only the data from respondents that had operated an ATV in the past 30 days were used (n=378). The study determined that farm youth operate ATVs more frequently than do non-farm rural youth; however, the farm youth did not sustain more injuries. Two predictors of injury were identified: 1) more than one person on an ATV at a time and 2) operation of an ATV more than three times per week. Age and helmet use were not found to be statistically significant risk factors. Another finding of this study was that ATV safety education appeared to have no protective benefits for the ATV driver. The authors suggested that further research is needed to explore the quality of teaching methods employed in ATV safety education. A limitation of the study included that the sample was drawn from adolescents enrolled in agricultural education programs in Arkansas and may not be a representative sample.

A qualitative study using focus groups with semi-structured interview sessions was conducted to identify participant attitudes and beliefs about ATV safety. The purpose of the study was to identify effective educational strategies that demonstrated improved participant ATV knowledge and practices (Aitken et al., 2004). Four sessions were conducted: two sessions for adults (n=17) and two for adolescents (n=23). The mean age of the adults was 48 and the mean age of the adolescents was 14. Prior to the sessions, participants were given a questionnaire to collect demographic data and data regarding their personal ATV use. Also prior to the study, a task force was formed to conduct data analysis. Task force team members included health educators, a trauma nurse, a pediatric emergency physician, a pediatrician and other interested parties. The authors of this study reported 17% of the participants wore helmets, 35% use an ATV four or more times per week, 52.5 % of the participants reported using an ATV for work and recreation and 67.5% of the participants allowed passengers to ride along. Adult and adolescent groups agreed that parents and others in the community need increased awareness about the dangers of ATVs, emphasizing that ATVs are not toys. Both focus groups noted that parental promotion of ATV safety is important. Furthermore, both groups reported that they began to ride on ATVs at a very young age and most had not participated in formal training. The adolescents selected public service announcements by sports figures, pop music icons or survivors of ATV crashes as credible and effective spokespersons to promote ATV safety. When asked about methods to maintain their interest in ATV safety, adolescents agreed that graphic pictures demonstrating the consequences of using an ATV improperly would be effective. Limitations of the study included the small

sample size and subject homogeneity. Inclusion of ATV safety with driver's education and hunting safety courses were general suggestions. Recommendations for future studies included formation and participation of community coalitions to approach ATV safety using multifaceted educational efforts. Evaluation of the effectiveness of education to improve ATV safety behaviors was also encouraged.

The purpose of a study by Goldcamp, Myers, Hendricks, Layne & Helmkamp, (2006) was to obtain an estimate of ATV ownership and ATV use on farms by children under the age of 20. The sampling frame was obtained from the United States Department of Agriculture 1997 Census of Agriculture. A geographic stratified random sample from this source was selected with a random sample of 50,000 households. Telephone surveys were used with an adjusted response rate of 78% reported. In this study, male gender was a significant risk factor where males sustained nearly 70% of the ATV related-injuries. Pertinent findings of this study included the following: 1) males between the ages of 10 – 15 sustained 70% of the injuries, 2) nearly 60% of the injuries occurred during recreational use, and 3) nearly two-thirds of the victims were not wearing a helmet at the time of the accident. The most common event was an ATV overturn with the ATV being larger than recommended for the age of the operator. Limitations were stated as potential for response and recall biases. According to the authors, the majority of the farm youth reported they had never attended an ATV safety course. Recommendations included the need for increased ATV safety education with hands-on ATV training. Further research of positive and/or negative confounding factors associated with ATV injuries was suggested.

A retrospective study was conducted by Cvijanovich, Cook, Mann, & Dean, (2001) in which three databases from the state of Utah were accessed to describe ATV related risk factors and injury patterns of children under the age of 16. The foci of this study were to identify risk factors and injury patterns of 1) those treated in Utah emergency departments in 1996 and 2) those admitted to Utah hospitals from 1992 to 1996. Identified risk factors included operation of ATVs by children under the age of eight, operating ATVs too large for the child, inclusion of passengers on the ATV, failure to wear properly fitted helmets, goggles, boots and gloves, and lack of enforceable laws. In 1996, there were 788 ATV related emergency department (ED) visits with over one-third (n=268) under the age of 16. Between 1992 and 1996, 406 people were admitted to Utah hospitals with nearly one-third of the patients (n=130) under the age of 16. Eight victims died as a result of their injuries with 50 % of this cohort under the age of eight. In Utah, during this time period, reported injury rates for those over the age of 16 were 1.71 per 100 ATVs driven and 3.41 per 100 ATVs driven for those under the age of 16. In the ED the most common injury patterns included orthopedic, skin and central nervous system, burns, chest and abdomen respectively. In rank order orthopedic, central nervous system, skin, abdomen and chest injuries were noted in those youth hospitalized. The cost of hospitalization exceeded $1.6 million dollars. Limitations of the study included the potential for underestimation related to incorrect coding of charts where ATV injury or ATV-related admission occurred. The study did not capture children treated in non-hospital settings such as clinics or physician offices. Recommendations included engineering improvements initiated by the ATV industry with legislative support, and

improved enforcement of current laws. The authors suggested there is a need for studies to ascertain current ATV safety education program effectiveness and coordinated efforts to raise parental consciousness regarding ATV safety.

In an ecologic study conducted by Keenan & Bratton (2004), ATV-related injury and fatality data from the state trauma registries and death certificate databases were accessed in Pennsylvania and North Carolina from January 1997 to July 2000. Demographic and injury patterns between the two states were compared. Pennsylvania was chosen because this state has had ATV laws in place since 1985 and North Carolina had no ATV laws in place. The purpose of the study was to ascertain if patterns of injury and types of injury resulting in fatalities between the two states were comparable. There were a total of 1080 cases of children admitted to level one or level two trauma centers in Pennsylvania (n= 858) and in North Carolina (n=222). Although Pennsylvania law prohibits use of ATVs by children under the age of ten, there were 63 subjects between zero to five years of age (7.3%), 176 children between the ages of six to ten (20.5%), and 619 children between the ages of eleven to fifteen (72.1%) were admitted to level one or level two trauma centers. In North Carolina, 30 children between the ages of zero to five (13.5%), 48 children between the ages of six to ten (21.6%), and 144 children between the ages of eleven to fifteen (64.9%) were treated in North Carolina level one or level two trauma centers. Nearly 40% of those injured required admission to an intensive care unit and nearly 8% required post-hospital admission to a rehabilitation inpatient facility. Injury patterns noted in this study in order of frequency were head, orthopedic,

abdominal, face, thoracic, and spinal cord. Head injuries were the leading cause of death and only 19% of this cohort was wearing a helmet at the time of injury. The authors emphasized the need for all ATV drivers to wear a helmet, although they noted that with the weight and speed of ATVs, use of helmets is of little benefit to protect the trunk and extremities. When the authors compared their findings with findings reported by the US Consumer Product Safety Commission, several commonalities were observed. Common risk factors such as male gender and operation of ATV at a young age were observed. Described as a study limitation, the authors disclosed that this was an ecologic study and not a population based study; therefore, the sample may not reflect the actual behaviors and trends of other children operating ATVs. The authors recommended that states without ATV regulation enact laws that forbid ATV use by children under the age of 16. Risky behaviors such as driving at night or driving while under the influence of alcohol or drugs, speeding, and performing stunts were identified as risk factors.

Several program reports for the 4-H farm safety, Farm Safety 4 Just Kids, and the *Progressive Farmer* programs were noted. These programs have been instituted in at least 20 states. In general, most programs reported demographic data about the participants and their pre-test and post-test scores (Hartling, Brison, Crumley, Klassen, & Pickett, 2004). Most of the programs presented two or more farm safety topics with ATV safety as one component of the content. None of these farm safety programs exclusively covered ATV safety. Moreover, relatively few were evaluated with any level of scientific inquiry regarding their effectiveness in preventing injuries through increased safety awareness, knowledge and behaviors (McCallum, Reynolds, Conaway & Givens, 2007).

One meta-analysis reviewed twenty-three studies conducted from 1991 to 2003, which evaluated the effectiveness of educational interventions conducted to reduce pediatric agricultural injuries (Hartling, Brison, Crumley, Klassen, & Pickett, 2004). The North American Guidelines for Children's Agricultural Tasks (NAGCAT) were used as a conceptual framework. To increase the rigor of this study, all research studies under consideration were scrutinized for four inclusion criteria elements. First, the research must include NAGCAT or other interventions with the study aim to prevent farm related pediatric injuries. Second, the research design must include a comparison group. Third, the study must include interventions relative to the pediatric population. Fourth, the report must include at least one intervention outcome that was measured objectively. The most frequently measured outcome was knowledge followed by changes in safety attitudes and behaviors. Only two longitudinal studies with measurements after 12 months following educational interventions were identified. Twenty studies included interventions to prevent agricultural injuries in children with twelve community-based programs, seven school-based programs and one farm-based program. In the seven school-based programs, all demonstrated improvement in short-term knowledge and attitudes that was directly attributed to the hands-on training of the participants. The community-based studies and the farm-based study revealed inconsistent findings although one community-based study demonstrated a reduction in fatalities over a two-year period. One of the most significant findings of this meta-analysis was the paucity of randomized, controlled trials to evaluate the effects of educational interventions. The authors expressed concerns, ethically and scientifically, about studies that were not

published due to lack of rigor and power, lack of peer-review or the decision to only report studies that demonstrated positive results. Recommendations by the authors for future research include studies using random control trials and community-based trials with planned rigor and statistical power. Furthermore, the authors suggested that objective outcome measures should include changes in pediatric injury rates in relation to educational interventions in lieu of knowledge measurement.

McCallum, Conaway, Drury, Braune & Reynolds (2004) studied knowledge and behavior changes using a written pretest, and a 3 to 4 month telephone post-test design with children between the ages of 8 – 13 who attended a *Progressive Farmer* Farm Safety Day Camp® program in 1999, 2000 and 2001. The day camp programs were flexible, that is, a variety of topics were available for selection by the program coordinator to meet the needs of the community. A power analysis was calculated to determine sample size for each year included in the study. The total number of participants for all three years was 1,780. There were three main purposes of the camps: 1) to engage children with interactive, hands-on safety training strategies, 2) to assist children in gaining new knowledge and attitudes about safety and 3) to reinforce previously learned safety knowledge. The pre-test, post-test questionnaires were designed using Likert scales with a total of 20 knowledge and behavior questions. Specifically, there were eight knowledge questions with one specific to ATVs, eight behavior risk questions with two specific to ATVs and four ATV safety gear risk questions. Results of this study demonstrated overall improvements in knowledge, behavior risk and ATV safety gear risk by age, gender, and farm contact in the group analyses. In the group

analysis: 52.1% of the participants demonstrated gains on the knowledge questions, 62.2% demonstrated gains on the behavior risk questions and 65.2% demonstrated gains on the ATV safety gear risk questions. Individually, however, some children performed the same or worse on any one question on the questionnaire. A major limitation was the lack of uniformity of the camp programs. As previously mentioned, the program directors could choose which topics to present to the camp participants based on community needs. Other limitations included possible instrument effect, lack of a comparison group and the need to consider reevaluation at a longer interval than 3 months to assess knowledge retention. The camps were held from late spring to fall of the year. Some of the post-tests were administered in the winter when the participants may not have been using the newly acquired safety knowledge and skills due to the weather, thus affecting test results. Self-report was also discussed as a potential threat to the validity of the exam. The authors noted that an indirect benefit of planning and implementation of the safety camps was the community involvement. Each camp required at least 60 community volunteers and nearly 20 local businesses, organizations and private individuals with donations of time and/or financial support to orchestrate the camps. Additionally, the authors pointed out that engagement of the community at this level empowers communities to address public health and safety issues that most affect them.

McCallum, Reynolds, Kelly, Conaway, & Braune (2006) conducted a study which evaluated the community benefits of the *Progressive Farmer* Farm Safety Day Camps® held in 2002. This study was part of a larger study using written reports from camp coordinators (n= 228) and camp volunteers (n= 5,037). A representative sample of 28

camps were randomly selected from the 253 camps held that year. Telephone interviews with parents (n= 924) of children participating in one of 28 camps were conducted three months post-camp. The interviews were designed to obtain information regarding safety behavior changes made by the child since attending the farm safety day camp. Fifty-seven percent of the parent respondents reported the camp was "very effective" and 38% reported the camp was "somewhat effective" in helping their child make safer choices. Nearly a fourth of the parents reported that their child had made at least one safety related change since attending the camp (McCallum, *et. al.*, 2006). Based on data analysis, 48% of the camp coordinators reported an increase in community safety awareness, and 15% reported that they continued to share safety information with family, friends and others after the camps had ended. Thirty-one percent of the camp volunteers reported they learned something new as a result of assisting with farm safety day camps and were planning safety related changes in their homes and farms. According to the authors, farm safety day camps provide children with opportunities to learn and then discuss what they have learned with their parents. This dialogue provides parents and children with opportunities to talk about safety issues on the farm including ATV safety. The authors concluded that camp coordinators and camp volunteers developed a broader sense of community empowerment to promote farm safety. Finally, the authors suggested that community cooperation to organize and promote farm safety day camps creates community cohesiveness that ultimately improves the health and livelihood of rural communities by reducing injuries and fatalities.

McCallum, Reynolds, Conaway & Givens (2007) evaluated the effectiveness of a *Progressive Farmer* Farm Safety Day Camp® program using a pre-test/post-test design. (This program is now known as the Progressive Agriculture Foundation Farm Safety Day Program™). Data for analysis of program effectiveness was part of a larger study. The sample consisted of children ranging in age from eight to 13 who attended one of the 28 camps randomly selected out of 253 camps held between March and October 2002. Of the 28 camps in this study, 17 were community-based camps and 11 were school-based camps. The non-camper comparison groups were selected from the community for each of the 28 camps with 209 children in the community-based non-camper group and 204 children in the school-based non-camper group. The authors reported multiple efforts to create appropriate comparison groups. The pretest was administered no more than two days prior to the start of the camp. The post-test was conducted via telephone surveys by trained telephone interviewers three to four months and 10 - 12 months after the camp concluded. The mean participant age was 10.15, with equal numbers of males and females. Results demonstrated improvement in knowledge for both the campers and the non-campers. The non-campers' improvements were attributed to maturation and/or frequency of testing. On the behavior items, all groups demonstrated improvement from the pre-test to post-test measurement and sustained improvement between the 3 month and 12 month measurements. Knowledge and behavior improvements were more significant in the camper versus non-camper groups. Results included data that supported program effectiveness for increased knowledge and reported safe behaviors with retention at 3 and 12 months post-program. Limitations included improvements in the

non-camper group with plausible explanations as previously mentioned. Suggestions include replication of this study including comparison groups.

Reed, Claunch, Cole, & Mazur (2006) examined the backgrounds, experiences, preparation and motivation of Farm Safety 4 Just Kids day camp instructors. The purpose of the study was to evaluate program effectiveness among the children, parents and the communities where the camps were held. All camps used community volunteers to plan and set-up the programs. Camp instructors were extension agents, groups of individuals from the Future Farmers of America organization (now known as the FFA) and equipment dealers. A purposive sampling of camp instructors was conducted from six Farm Safety 4 Just Kids (FS4JK) day camps. Data were collected via a two-page survey of 69 instructors conducting FS4JK day camps in 2002. Video and audiotapes of the instructors conducting the camp were also used. This study found that 61of 69 (80%) camp instructors either live on a farm or have worked extensively on a farm. Sixty-three of the camp instructors (91%) knew someone that had suffered from a farm-related injury and 17 (25 %) had personally survived a serious farm-related injury. This important variable adds credibility with children when an instructor discusses issues of safety with meaningful, relevant stories of personal experience. In response to the instructor experience question, 20 instructors (31%) reported having taught the camp once before or this was their first encounter, and 12 instructors (19%) had taught two to five times previously. Thirteen instructors (20%) had taught nine to ten times, followed by nineteen instructors (30%) who reported having taught 10 times or more. Regarding instructor educational training, nine (13%) reported having no prior training in child pedagogies, 44

(64%) reported "some" training and 16 (23%) reported having "a lot" of training (Reed, *et al*., 2006, p. 183). The authors noted most of the instructors used "didactic teaching," presented "enthusiastically" with an "engaging tone of voice" and used "concrete" items to support the lecture content (Reed, *et al.*, 2006, p. 188). Lack of experience or training in pedagogical theories of instruction were two identified weaknesses of the instructors. The authors further noted heavy reliance on instructor-lead lecture-based presentations. Thirty-three instructors (48%) reported using topic related printed materials. Features of the printed materials considered important by the instructors included content, reading level, pictures, color and price respectively. The video however, captured only one instructor handing out printed materials during the presentation. Other instructors reported that printed materials were placed in goodie-bags and distributed to the children. The instructors reported pressure to cover a plethora of material in a very brief period of time. Furthermore, the instructors reported there was little, if any, feedback given to them regarding their performance as an instructor. Recommendations included providing guidance and assistance to volunteers to adequately prepare for the camp. The authors concluded that one goal of the day camp coordinator should be the provision of timely, constructive feedback to the volunteer instructors.

Using a multidisciplinary approach, two public health nurses collaborated with agriculture teachers in high schools to prevent adolescent agricultural injuries (Reed & Kidd, 2004). This study used the Transtheoretical Model of Change as its framework and used a researcher developed Agricultural Disability Awareness and Risk Education Model (AgDARE). The AgDARE model integrates the contemplation and action stages

of the Transtheoretical Model of Change to prevent adolescent agricultural injuries using reality-based cases and multiple age-appropriate instructional methods. The purpose of the study was to ascertain if the subjects could move from thinking about farm work safety to actively practicing farm work safety behaviors via an educational intervention (Reed & Kidd, 2004). Twenty-one schools from three states with two intervention groups and one control group were used. A total of 373 students were included in the intervention group and 417 students were included in the control group. The curriculum of the educational intervention included "narrative simulations" of "real life situations" where the students made critical decisions about the safest way to react followed by discussion about whether their decisions were safe or hazardous (Reed & Kidd, 2004). The second component to the educational intervention included psychomotor skills stations where the students pretended to have one of four frequently occurring farm related injuries (amputation, spinal cord injury, hearing loss and respiratory diseases) and attempted to perform farm related tasks. Following this intervention the nurses led discussion with the students to explore their thoughts and feelings about work performance and farm work related disabilities. The researchers developed two 5-point Likert instruments: First, an eight-question instrument called the Farm Safety Attitude instrument that measured adolescent attitudes about farm-safety disability and their personal ability to avoid injury. The other instrument, the Stages of Change, had 10 items that measured contemplation and action. Students evaluated the curriculum via a questionnaire with 20 questions using a 5-point Likert scale. Seven to 14 months after the educational intervention, the researchers visited a subset of the total participants to

observe the students as they engaged in their farm work. Supported by the data, the students believed they had the ability to prevent farm-related injuries. Another finding demonstrated that students who participated in the AgDARE intervention took more action to reduce potential injury than students in the control group. Identified as a limitation, the researcher-developed instruments will require further psychometric testing. Another limitation of the study was the self-report of the adolescents that may have resulted in reliability bias either due to inaccurate self-assessment abilities or inaccurate self-assessment of their behaviors. Additionally, it was noted that some adolescents could have fabricated responses. The researchers cited advantages of collaboration between agriculture teachers and nurses as important because both teachers and nurses are generally well-known to other members of the community, have awareness of injuries frequently occurring in the community and can adapt teaching modules to best fit the needs of the community. Implications include replication of the study using other safety related topics. Additionally, the educational interventions should be translated to foreign languages, such as Spanish, thus addressing the needs of ethnic groups also engaged in farm work.

In a study conducted by Burgus (n.d.), Farm Safety 4 Just Kids in collaboration with the Great Plains for Agricultural Safety and Health Center directed a survey with 623 respondents at the 2005 National Future Farmers of America Convention in Louisville, Kentucky. The purpose of this study was to determine current ATV training status and helmet use among adolescents, and behaviors typical of youth using ATVs (Burgus, n.d.). Significant findings of the study revealed that 26 % of the respondents

never wear a helmet and those living on a farm are less likely to wear a helmet than those who did not live on a farm. Female respondents reported being more likely to wear helmets; however, they reported being more likely to allow a passenger to ride along. Only 22% of the respondents reported they had previously attended an ATV safety-training program. The findings of the study suggest that adolescents are engaging in unsafe practices that may be eliminated by attending an ATV safety-training program. The author concluded that the findings would be used to guide future interventions designed to reduce ATV related injuries in this population.

In recent years, Alaska has experienced ATV-related injury and fatalities that are similar to Kentucky. Ferguson and Hill (2005) conducted a study that was specific to promoting ATV safety in Alaska. The purposes of the study were to determine actual ATV behaviors and to gain insight regarding knowledge and attitudes of the target audience and the community regarding ATV use. In Alaska, during 2003 – 2004, there were 32 ATV-related injuries in children between the ages of 10 - 18. Thirty four percent sustained traumatic brain injuries with the cost of hospitalization at $329,877.00 (Ferguson & Hill, 2005). Data included in this study were gathered from observational and self-administered surveys, focus and discussion groups, and key informant interviews. Alaskan Native American and non-Natives ages 10 to 18 responded (n=136). Males were more frequently observed engaging in risk taking behaviors. ATV driver and passenger failure to wear a helmet was noted 100% of the time in three of the four communities observed by the researchers. In the remaining community, 84% of the ATV drivers were not wearing a helmet and 71 % of the passengers failed to wear a helmet.

Other risk taking behaviors observed in order of frequency was speeding, racing, and performing donuts and wheelies.

According to Ferguson and Hill (2005), the qualitative data from the focus and discussion groups provided rich detail regarding risky behavior such as failure to wear a helmet and reasons for their choices. The participants discussed preferences and dissatisfactions about helmets and noted that most helmets were too heavy, too hot, or ill fitting. Complaints about full-face helmets revealed that they tend to fog up easily. Over 80% of the adolescents stated they would wear a stylish and lightweight helmet if it were provided at low cost or free of charge. Most of the children reported there was no enforcement of ATV laws in their communities and one-third of them indicated they would obey laws if enforced. Most believed they were experienced riders and did not fear serious injury; however, over 50% had sustained a minor injury or had fallen off their ATV. Similarly, only 50% believed an ATV safety course would be beneficial but the majority felt it would benefit younger children. Other participants in this study (tribal leaders, school principals, other community leaders and parents), concurred regarding the need for greater parental and child accountability in terms of ATV use, adherence to safe ATV practices (helmet use for example) and enforcement of existing ATV laws. Suggestions by this group included the need for meaningful punishment for violation of the laws with incentives and rewards for adherence to the laws. Formation of a youth safety commission, involvement of youth in developing and presenting ATV safety programs and approaching businessmen to offer popular ATV helmets at cost or free was also suggested.

In summary, the literature search revealed a policy statement by the AAP and NAGCAT guidelines for safe ATV use in the agricultural setting. Several studies were found that focused on the etiology, mechanism of injury, morbidity and mortality rates and outcomes of victims involved in ATV-related crashes. Common injuries related to ATV crashes include: skin, orthopedic, head/face, brain/CNS, chest/thorax and abdominal injuries (American Academy of Pediatrics, 2000; American College of Surgeons, 2002; American College of Orthopedic Surgeon, 2002; Emergency Nurses Association Injury Prevention Institute, 2006; Bhutta, *et al*, 2003; Adams, *et al*, 2004; Fonseca, *et al*, 2005; Humphries, *et al*, 2006; and Keenan & Bratton, 2004). Care of ATV crash victims often requires multiple resources. Three studies reported the significant financial burden, hospital length of stay and intensive care length of stay as a result of injuries sustained as a result of ATV crashes (Humphries, *et al*, 2006; Cvijanovich, *et al*, 2001; and Ferguson & Hill, 2005).

Many studies discussed common risk factors, risky behaviors and predictors of injuries. These were identified as: male gender, ATV drivers under the age of 16 or over the age of 60, failure to wear a helmet and other protective equipment, overestimation of psychomotor skills and cognitive abilities of the ATV driver, failure to heed recommended ATV size and age restrictions, passengers on ATV intended for single riders only, and lack of ATV training or awareness of ATV safety guidelines (Fonseca, *et al*, 2005; Adams, *et al*, 2004; Humphries, *et al*, 2006; Aitken, *et al*, 2004; Goldcamp, *et al*, 2006; Cvijanovich, *et al*, 2001; Keenan & Bratton, 2004; Burgus, n. d.; and Ferguson & Hill, 2005). Jones & Bleeker (2005), however, reported that ATV driver age and

helmet use was not found to be statistically significant. Furthermore, Jones & Bleeker (2005) also stated that their study did not demonstrate that ATV safety education protected youth from ATV-related injuries.

A few studies noted that some ATV users are very young. The mean age in the Bhutta (2003) study was 11.6 years as compared to 14 years in the Aitken (2004) study. According to Cvijanovich, (2001), eight children in Utah under the age of 16 died as the result of ATV-related injuries between 1992 and 1996 with four of those under the age of eight. In the Keenan & Bratton (2004) study, 239 children in Pennsylvania and 78 children in North Carolina under the age of ten were treated for ATV-related injuries in level one or level two trauma centers from January 1997 to July 2000. Thus, the literature overwhelmingly emphasizes the young age of ATV users.

Studies focusing on the qualifications, characteristics and instructional methods of farm safety instructors or ATV safety educators were included. Also mentioned in these studies were recommendations to review and revise instructional methods and strategies with consideration to the target audience. With the exception of the Aitken (2004) study, the other studies focused on the effectiveness of general farm safety programs with inclusion of a small component of ATV safety. (Jones & Bleeker, 2005; Aitken, *et al*, 2004; Cvijanovich, *et al*, 2001; Reed, *et al*, 2006; Reed & Kidd, 2004; Ferguson & Hill, 2005; and Burgus, n. d.).

A variety of study designs and methods were identified in the literature review, including retrospective studies using existing data bases (Bhutta, *et al*, 2003; Adams, *et al*, 2004; Fonseca, *et al*, 2005; and Humphries, *et al*, 2006). Jones & Bleeker (2005)

conducted a cross-sectional study design using a survey. Two qualitative studies using focus groups, direct observations and semi-structured interviews were used (Aitken, *et al*, 2004; and Ferguson & Hill, 2005). Hartling, *et al*, (2004) conducted a meta-analysis using NAGCAT as a conceptual framework. Keenan & Bratton (2004) conducted an ecologic study using existing databases from two states. Reed & Kidd (2004) used a pre-test/post-test design with a comparison group using the Transtheoretical Model of Change as a conceptual framework. Other studies using pre-test/post-test designs via secondary analysis were explored (McCallum, *et al*, 2006; Reed, *et al*, 2006; and McCallum, *et al*, 2007). Calls for additional studies using random control trials or comparison groups with planned rigor and statistical power were made (Hartling, *et al*, 2004 and McCallum, *et al*, 2007). Finally, the literature search revealed no studies that exclusively evaluated the effectiveness of the ATV safety program known as the Farm Safety Program – ATV Training Course provided by the Kentucky Department of Agriculture.

Chapter III

Framework

William Haddon, a public health physician, is best known as the father of modern injury epidemiology. In the 1960's, Haddon worked for the National Highway Traffic Safety Administration and developed a conceptual model identifying etiological factors associated with motor vehicle crashes and potential preventive strategies to reduce the incidence and severity of injury (Runyan, 2003). In his theory, injury occurs as a result of uncontrolled, environmental energy (mechanical, chemical, and thermal, radiant, electrical) from the environment and exerted onto the individual. Therefore, according to Haddon, the causative agent of injury is uncontrolled energy.

Haddon developed an organized approach for the identification of causative injury factors and injury prevention strategies, termed Haddon's Matrix, which is composed of three factors and three phases. The three factors depicted in columns include the host, the agent and the environment. The three phases, the pre-event, event and post-event phases depicted in rows, are used to identify points in the evolution of an injury. See Table 1.

In this pilot study, the host is the adolescent ATV operator/driver. Identified host risk factors include age (less than 16 years of age), level of cognitive and physical development, and gender. ATVs require high-level psychomotor skills, strength, and cognitive abilities to operate (North American Guidelines for Children's Agricultural Tasks, n.d.). Despite its name, ATVs are designed for off-road use only and for the purposes of this study the ATV is the agent. All-terrain vehicles are similar to

motorcycles; the seats are straddled with handlebars used for steering and the engines are measured in cubic centimeters of displacement (Rodgers & Adler, 2001). The ATV industry manufactures many models with most buyers preferring to purchase adult sized ATVs with larger, high performance engines. ATVs that have not been properly maintained and repaired increase the likelihood of malfunction. Installation of roll-over protection devices, safety cage development, seat belts and further research dedicated to ATV safety design are examples of engineering technologies to significantly promote injury prevention and control (American Academy of Pediatrics, 2000).

The third factor is the environment that includes physical, legal and social features. The physical environment includes the presence of wildlife and the presence of steep hills, unforeseen debris, and abrupt deep drop-offs in the terrain. Use of topography maps and a compass can reduce the likelihood of becoming lost. Adolescent ATV operators should notify a responsible person, such as a parent, of the route plan and time of expected return. This is an especially important practice to aid emergency response teams if services become necessary. There are terrains that have been commercially established and maintained specifically for ATV use. Obtaining permission of private and commercial landowners prior to operating an ATV on their property is not only proper etiquette but also a safety issue. Owners are usually aware of hazardous areas to avoid on their property.

Kentucky, like most states across the nation, has passed legislation restricting use of ATVs as KRS 189.515 (Kentucky Statute, 1998). In Kentucky, to drive an ATV under the age of 16, the child must wear protective headgear and must be under direct

parental supervision while the ATV is in motion. Furthermore, a child under the age of 16 must not drive an ATV greater than 90cc displacement; if the child is under the age of 12, the child must not drive an ATV with more than 70cc displacement. Use of ATVs on public roads is prohibited except to engage in occupational uses such as farming and agriculture. When operating an ATV on pavement becomes necessary, the driver must be a licensed driver obedient to all traffic regulations. Unfortunately, ATV use on private property or when used for agricultural or occupational purposes are not subject to these laws. Current Kentucky ATV related laws are difficult to enforce because ATV use frequently occurs on private property. Increased community awareness and involvement has been associated with positive outcomes (Aitken, et al., 2004). Therefore, members of the community must appreciate the laws and report inappropriate use of ATV to the authorities in an effort to reduce ATV related injuries and fatalities.

Social factors include lack of parental supervision, limited family and/or adolescent awareness or appreciation for risks factors, and/or lack of parental and adolescent accountability. These attitudes and behaviors are potentially amenable to educational interventions (Ferguson & Hill, 2005). Additionally, lack of financial resources to purchase ATVs of the correct size and personal protective gear impede actions known to reduce risk factors.

Haddon's Matrix also consists of three phases where injury prevention and control is the focus: the pre-event, the event and the post-event. Blunt or penetrating forces are the primary causes of injury (Runyan, 2003). The pre-event phase is very

similar to primary prevention in health promotion. The focus of the pre-event phase is to decrease the vulnerability of the host to injury. Use of ATVs appropriate to the age of the ATV operator is essential to injury prevention and injury control. Educational interventions increase participant awareness for the need to wear appropriate protective gear (helmets, eye protection, gloves, and boot, long-sleeves and long pants). Participants are taught to observe and practice ATV safety concepts through the use of topographical maps, ATV maintenance checks and repair kits, and how to select an appropriate sized ATV. Furthermore, educational interventions promote parental and personal accountability through discussion and photos of known risk factors and risky behaviors to reduce the incidence of ATV accidents.

The event phase is the point in time where energy is transferred from the environment to the individual. The focus of the event phase is to reduce the severity of injury when there is a transfer of energy. This concept is very similar to secondary prevention in health promotion. Hands-on training during ATV safety training programs teaches the participants how to lean their bodies correctly and turn the wheels of the ATV to maintain control of the vehicle to avoid serious injury. Additionally, participants are taught how to maneuver the ATV around trees, tree limbs and dangerous terrain through the hands-on obstacle course. Often the participants gain valuable first hand knowledge of how protective gear and their physical size and strength limitations on an ATV affect their safety in the controlled environment of a hands-on training session.

The third phase is the post-event phase where factors (host, agent and environment) are evaluated or reviewed after the energy transfer has occurred to minimize future death or disability as a result of an ATV crash. For example, in the post-event phase the general health and body system(s) of the injured (the host) are evaluated. The post-event phase is similar to tertiary prevention in health promotion. For the victim of an ATV crash, this phase is focused on strategies minimizing disabilities and other adversities that negatively impact quality or quantity of life. The availability of the emergency response system to provide effective and timely care with appropriate sized pediatric supplies is considered. The location of level one trauma centers and rehabilitation centers should be taken into account as well. Refer to Table 1.

In this pilot study a questionnaire was developed by the researcher with a total of 51 questions: 11 demographic questions, 20 knowledge questions and 20 questions addressing participant behavior and attitudes regarding ATVs. Of the knowledge questions: seven inquired about the host, six questions about the agent and seven questions about the environment were proposed. There were six questions specific to attitudes regarding personal protective gear. Additionally, seven host-related, three agent-related and four environmental-related behavior questions were included in the questionnaire.

Research Question

One research question for this study was proposed: Does an ATV safety program improve safety knowledge, attitudes and behavior in adolescents ages 12 to 18?

Table 1.

Example of Haddon's Matrix Applied to ATV Crashes

Phase	Host	Agent	Environment
Pre-event	operator experience, operator training, ATV education, psychomotor skills, cognitive & physical development	maintenance, weight, and size of ATV, use of speed governors, flags, reflectors, headlights, access to repair kit	rugged or irregular terrain, poor visibility, regular trail maintenance, owner consent to use land, adult evaluation of driver abilities, adult supervision
Event	individual tolerance to crash forces, proper protective gear, risk-taking behavior, carrying passengers	crash worthiness of ATV, leg guards, engine covers, roll over protection system, seat belt use	presence of fixed object or unsecured object on impact, community attitudes and watch, effective laws and law enforcement
Post-event	crash victim's health status, body system injured, flair use to to summon help	regulations improving crash worthiness of ATV, funds for ATV safety research	availability of effective and timely emergency care, parent awareness of route plan & return home time

Definition of Terms

The following terms were defined for the questionnaires and this study:

Farm was defined as a section of land used in the production and management of plants, produce or livestock.

An *ATV* was defined an all-terrain vehicle with three or four wheels and does not include gators, mules or other utility vehicles.

Momentum was defined as the way or means to keep the ATV moving forward.

Attitude was defined as an inner conviction formed through interactions with the environment that shapes or guides individual behavior (Mosby Elsevier, 2006).

Behavior was defined as individual actions that are observable or maybe inferred and interpreted (Mosby Elsevier, 2006).

Knowledge was defined as individual understanding about preventing unintentional injuries (Mosby Elsevier, 2006).

In review, ATV injuries and fatalities are a public health issue. Haddon's Matrix is a framework to conceptually identify patterns of behaviors, attitudes and knowledge deficits associated with ATV crashes. Identification of these patterns contributes to predicting and preventing future ATV-related injuries and fatalities. The use of this model demonstrates etiologic factors associated with ATV crashes to identify injury prevention and control strategies. Barriers to safe ATV operation are detected and educational, engineering and enforcement interventions are discussed to minimize the occurrence of ATV related injuries and fatalities.

The purpose of this study was to determine if the KDA ATV safety-program improves ATV safety knowledge, attitudes and behaviors in adolescents ages 12 to 18. The research question was proposed and terms used on the questionnaire and for this study were operationally defined. Haddon's Matrix was used to develop the questionnaire to identify potential knowledge gains and potential changes in attitudes and/or behavioral intent subsequent to the KDA ATV safety-program educational intervention.

Chapter IV

Methods

The chapter describes the methods used in this study. The design, sample and setting, protection of human subjects, inclusion criteria, and data collection procedures are reviewed.

Design

For this pilot study, a one-group pre-experimental pre-test/post-test design was selected. The questionnaire consisted of three parts: demographic data, multiple choice and true or false questions to assess ATV knowledge, and visual analog scales to assess ATV related behaviors and attitudes. The questions were formulated based on the content contained in the 4-H ATV Rider Handbook supplied by the safety administrator for the Kentucky Department of Agriculture Farm and Home Safety Program (National 4-H Community ATV Safety Program, n.d.). The safety administrator used this content for his didactic and hands-on presentation. Four ATV safety experts, residing in three states, in were consulted for content validity of the researcher-developed questionnaire.

Prior to using the questionnaire the literacy level of the study participants, adolescents ages 12 to 18, was considered. To measure the grade readability and comprehension level of the questionnaire, the Simple Measure Of Gobbledygook (SMOG) formula was used, indicating the questionnaire was at the seventh grade level (Bastable, 2003). Unlike other readability formulas, the SMOG formula results indicate that persons reading at the seventh grade level are able to fully comprehend the material in the questionnaire. The SMOG formula is considered reliable and valid for grade-level

readability and comprehension of printed material (Bastable, 2003).

Sample and Setting

Using convenience sampling, participants who were pre-registered to attend an ATV safety program were recruited to complete the questionnaires. The ATV safety program was held in a south central Kentucky agricultural exposition center.

Inclusion Criteria

Inclusion criteria for participation in the research study were: 1) parent and subject must be able to read and comprehend English, 2) subject must be between the ages of 12 – 18 on January 26, 2008, 3) informed verbal and written parental consent (Appendix A), 4) verbal and written subject assent (Appendix B), and 5) the adolescent was pre-registered to attend the ATV safety educational program.

Protection of Human Subjects

Prior to conducting this research study, the pilot study proposal was reviewed and received full approval from the Western Kentucky University Human Subjects Review Board. The Kentucky Partnership for Farm Family Health and Safety sponsored the ATV safety program. A flyer was used to promote the program and to request reservations. Upon receipt of the registration, the president of the Kentucky Partnership contacted the parent or legal guardian, and explained the study and opportunity to participate. Upon arrival for the ATV safety program, parents and potential subjects were approached about their interest in participating in a research study. Interested candidates were given a verbal and written explanation of the purpose, process and

procedures of the study. The right to decline participation in the study and assurances that either the parent or the potential subject had the right to withdraw from the study at any time without penalty were stressed. Furthermore, participation in the ATV safety program was not contingent upon engagement in the research study. This point was particularly emphasized to parents and potential subjects by the researcher.

Intervention

The safety administrator for the Farm and Home Safety program, a division of the Kentucky Department of Agriculture, and his assistants conducted the ATV safety education training. The agenda of the program consisted of a standard one-hour didactic instruction followed by a hands-on training course. A PowerPoint presentation was used to supplement the didactic content. The presenter used personal experience and age appropriate photos of ATV crash scenes in the PowerPoint presentation. He was enthusiastic and reminded the adolescents about their ability to make safety a daily choice. The hands-on training course included a pre-ride safety check. During this time the subjects were required to select and wear all ATV safety gear. Discussion about appropriate sized ATVs was included. Finally, participants navigated an ATV through an obstacle course. Each adolescent was scored by at least two KDA assistants and given feedback about their strengths and weaknesses in safe operation of an ATV.

Incentives in the form of safety prizes were provided. First place received $100.00, second place received $50.00 and third place received $25.00. The safety prizes were awarded to the participants during the Kentucky Partnership for Farm Family Health and Safety annual meeting held on January 26, 2008.

Data Collection

Twenty-eight (28) pre-registered participants attended the ATV training program; two of the pre-registered participants were under the age of twelve and two participants declined to participate as participants in the study. The questionnaires were administered to the participants just prior to the ATV safety program and immediately following completion of the ATV safety program. Six participants failed to complete both the pretest and post-test questionnaires and the data from those six were deemed ineligible for use. The total number of participants included in the pilot study was 18.

Initially, the demographic section of the questionnaire (Appendix C) was given to the participants. The questionnaire contained 11 questions pertaining to gender, date of birth, whether or not the participants live or work on a farm, whether or not they had ever driven an ATV, their frequency of driving and riding as a passenger on an ATV. Further inquiry included whether or not the participant had ever attended an ATV training course in the past and if so how long ago, whether their use of an ATV was for work or recreation or both and finally their age when they first began to drive an ATV.

After completing the demographic section, the participants were given verbal and written definitions of the terms “farm”, “all-terrain vehicles”, “ATV” and “momentum” to aid completion of the questionnaires. For the purposes of this study these terms were operationally defined and can be found in Chapter Three. Participants were also provided with verbal instructions and a visual demonstration on how to make a mark on the visual analog scales used in the questionnaires that represented their attitude and behaviors.

To assess ATV related knowledge, the questionnaire contained a total of 20 multiple choice and true/false questions which were identical for pre-test and post-test (Appendix D). A visual analog scale using the standard 100 mm line with "never" at the zero anchor line and "always" at the 100 mm anchor line was used on both the pre-test and post-test. A total of 20 items were included on the questionnaire to assess ATV safety attitudes and behaviors. Of the 20 items, 17 positive behaviors and three negative behaviors were represented.

On the pre-test (Appendix E), the participants were asked about current ATV behaviors with the following caption, "When driving an ATV, how often do you…." Likewise the post-test (Appendix F) asked the participants, "When driving an ATV in the future, how often do you plan to…" The intent of the questions was to determine present attitudes and behaviors pre-test to compare with post-test attitudes and behaviors.

In summary, the purpose of this pilot study was to determine if an ATV safety educational program is effective in improving safety knowledge, attitudes and behaviors in adolescents ages 12 to 18. A pre-experimental one-group pretest, post-test design was used. A convenience sample of 18 subjects was included in the study. A self-report questionnaire was used to collect the demographic, knowledge, attitude and behavior data.

Chapter V

The findings of this pilot study are reported in this chapter. Descriptive statistics are used to summarize the demographic data. Knowledge, attitude and behavior data were analyzed using the paired ***t***-test statistic. The level of significance was set at $\alpha = < .05$.

Results

The knowledge pre-test and post-test data were manually checked and summed. Data were entered into SPSS – 14 for analysis and was rechecked to eliminate data entry errors. The demographic data were analyzed using descriptive statistics; the knowledge pre-test and post-test summed raw scores as well as the attitude and behavior scores were analyzed using the paired ***t***-test statistic. The alpha level was set at <0.05 and the sample size were eighteen (n=18).

Demographic Data

The demographic data revealed that 10 participants (55 %) were male and eight (45 %) were female. The mean age was fourteen. On average, the participants began to drive an ATV at eight years of age. Fifteen participants (83 %) reported having driven an ATV, while three participants (17 %) reported never having driven an ATV. In contrast, only four participants (22 %) reported having attended an ATV safety training class previously and 14 participants (78 %) revealed they had never taken an ATV safety training class. Eleven participants (61 %) reported they live on a farm and seven (39 %) reported they did not. Refer to Table 2 and Table 3.

Table 2.

Summary of Demographics by Age and Gender

	Mean	Range
Age of participant in study	14	12 - 16
Age when first began to use ATVs	8	5 - 11

Gender	Number	Percent
Male	10	55
Female	8	45

Table 3.

Participant Use of ATVs

	Yes	Percent	No	Percent
Ever driven an ATV	15	83	3	17
Ever attended an ATV safety class	4	22	14	78

Five participants (27 %) indicated they have never worked on a farm and two participants (11 %) revealed having worked only once on a farm. Three participants

(17%) reported they work on a farm during the summer or other season of the year. Two participants (11 %) reported they've worked on a farm at least once a month while six participants (34%) report having worked on a farm at least one day a week. Refer to Table 4.

Table 4.

Frequency of Participants Working on Farms

Frequency	*Number*	*Percent*
Every day	1	6
4 - 6 days a week	3	17
1 - 3 days a week.	2	11
Once a month	2	11
Summer or other season	3	17
One time only	2	11
Never	5	27

Three participants (17%) never drive an ATV while one participant (6%) reported driving an ATV less than once a month and one (6%) participant reported driving an ATV once a month. Four participants (21%) drive an ATV once a week and seven participants (38%) reported they drive an ATV at least two to three days each

week. Two participants (12%) reported driving an ATV four to seven days per week. Refer to Table 5.

Table 5.

Frequency of Participants Driving All-terrain Vehicles

Frequency	Number	Percent
Every day.	1	6
4 - 6 days a week.	1	6
2 - 3 days a week.	7	38
Once a week.	4	21
Once a month.	1	6
Less than once a month.	1	6
Never.	3	17

Of the ATV drivers, nine participants (49%) operate an ATV for work and recreation, five participants (28%) ride for recreation only and one participant (6 %) reported using an ATV for work reasons. Three participants (17 %) that had never driven an ATV were classified as “other”. Refer to Table 6.

Table 6.

Summary of Reasons Participants Drive All-terrain Vehicles

Reasons	Number	Percent
Work	3	17
Recreation	1	6
Work and recreation	5	28
Other	9	49

Five participants (28 %) reported never having been an ATV passenger; seven participants (38%) revealed having been a passenger on an ATV less than once a month, two participants (11%) reported being a passenger once a month, no participants reported being a passenger once a week, three participants (17%) were passengers two to three times a week, no participants reported being a passenger four to six days per week, and one participant (6%) was a passenger on a daily basis. See Table 7. Four of the participants (22 %) reported it had been three years or more since they last attended an ATV safety program, while the majority of the participants (n= 14, 78 %) reported never having attended an ATV safety program.

Knowledge, Attitudes and Behavior Data

Research question: Does an ATV safety program improve safety knowledge, behaviors and attitudes of adolescents ages 12 to 18? Using the paired ***t***-test statistic, the

Table 7.

Summary of Participants Riding an All-terrain Vehicle as a Passenger

Frequency	Number	Percent
Every day	1	6
4 - 6 days a week	0	0
2 - 3 days a week	3	17
Once a week	0	0
Once a month	2	11
Less than once a month	7	38
Never	5	28

significance level was set at $\alpha = <0.05$. Out of a possible 20 points possible on the knowledge questionnaire, the pretest mean was 12.72 and the post-test mean was 13.72; thus, the knowledge questionnaire revealed no statistical difference between pre-test and post-test data ($t = -1.26$, $p = .224$). However, mean responses to sixteen of the twenty questions on the behavior and attitude questionnaire demonstrated statistically significant improvements from pre-test to post-test data. Refer to Table 8.

Table 8.

Comparison of Pre-Test and Post-Test ATV Behaviors and Attitudes

Behavior/Attitude Item	*Mean* Pre-test	*Mean* Post-test	***t***	***p***
1 use a map and a compass	0.823	58.41	-5.68	.000**
2 scan the terrain for holes, ruts, bumps, obstacles & wildlife	54.17	89.82	-3.78	.002**
3 wear a helmet	58	98.82	-3.85	.001**
4 encourage your friends to wear a helmet	55.52	96.64	-3.6	.002**
5 get permission from landowner before riding on their land	72.88	97.58	-2.61	.019*
6 let someone know the route you plan to take	62.94	93.88	-3.03	.008**
7 consider dangers of driving an ATV after dark	62.23	91.17	-3.22	.005**
8 let someone know when you plan to return home	75.17	96.7	-3.09	.007**
9 take frequent breaks on long rides	38.76	80.52	-4.09	.001**
10 let younger kids drive ATVs without supervision	11.7	9.17	0.28	0.782
11 carry a vehicle repair kit	30.94	69.88	-3.15	.006**
12 allow passengers to ride along	44.94	35.17	0.82	0.423
13 carry drinking water	41.76	72.76	-2.41	.028*
14 test your driving skills to the limit (e.g. jumping off ramps)	22.76	24.52	-0.17	0.86
15 wear a helmet	62.52	98.64	-3.43	.003**
16 wear eye protection	47.52	91.94	-4.07	.001**
17 wear gloves	60.52	92.94	-3.13	.006**
18 wear boots	67.64	89.64	-2.27	.037*
19 wear long sleeves	66.52	92.47	-2.89	.011*
20 wear long pants	79.11	93	-1.9	0.075

*Significant ***p < 0.05.***

Significant ***p<0.01.* Scale: 0= "never", 100 = "always"

The most significant statistical changes in attitude and behavior related to participants' intent to use a map and a compass (t = -5.68, p = .000), take frequent breaks on long rides (t = -4.09, p = .001), and encourage friends to wear a helmet (t = -3.6, p = .002). They also plan to get permission from the landowner before riding on their land (t = -2.61, p = .019), as well as carry drinking water with them (t = -2.41, p = .028).

Participants also responded more positively following the ATV training with intent to wear protective gear, specifically eye protection (t = -4.07, p = .001), gloves (t = -3.13, p = .006), a helmet (t = -3.85, p = .001), long sleeves (t = -2.89, p = .011), and boots (t = -2.89, p = .037).

Other significant changes following the intervention included participants' intent to scan the terrain for holes, ruts, bumps, obstacles & wildlife (t = -3.78, p = .002), consider dangers of driving an ATV after dark (t = -3.22, p= .005), carry a vehicle repair kit (t = -3.15, p = .006), let someone know his or her route (t = -3.03, p = .008) and planned time to return home (t = -3.09, p = .007).

There were four questions that failed to show statistical significance. Referring to Table 8, the questions specifically were #10) letting younger children drive ATVs without supervision, #12) allowing passengers to ride along, #14) testing driving skills to the limit, for example jumping off ramps and wheelies and #20) wearing long pants.

In summary, no statistical difference was detected regarding gains in knowledge between pre-test and post-test data. Statistical significance (p=<0.05) was demonstrated

in sixteen of the twenty behavior and attitude questions. However, three of the four items that failed to demonstrate statistical significance regarding ATVs were concerned with risky ATV behaviors.

Chapter VI

This pilot study examined the effectiveness of an ATV safety educational program provided by the Kentucky Department of Agriculture in improving safety knowledge, attitudes and behaviors in adolescents. Information collected in the literature search are compared and contrasted with the findings of this study. Limitations to the study are presented as well as suggestions for future studies and implications for nurses.

Discussion

Analysis of the demographic data from this pilot study revealed the average age when the participants began to drive an ATV was eight years (SD = 3.2); however, some of these children were using ATVs before the age of five. This age is younger than the results reported in the Bhutta, Greenberg, Fitch & Parnell (2003) study where the mean age of ATV accident victims was 11.6 years and 14 years of age in the Aitken et al. (2004) study. This age is similar to the results reported in the Keenan & Bratton (2004) study where 63 children between zero to five years of age and 176 children between six to ten years of age in Pennsylvania, and 30 children between zero to five years of age and 48 children between six to ten years of age were injured in North Carolina from January, 1997 to July, 2000. Additionally, the mean age of participants in this study was 14; whereas, the mean age of participants in the McCallum, Reynolds, Conaway & Givens (2007) was 10.15 years old.

These findings underscore the need for ATV safety education of children and their parents long before the children reach adolescence. Educational programs such as

the ***Progressive Farmer*** Farm Safety Day Camp® programs and the Farm Safety 4 Just Kids day camps are needed to increase ATV safety awareness in school age children on a regular basis. Involving parents and community volunteers in these programs has been recommended in the literature (Aitken, et al., 2004; McCallum, Reynolds, Kelley, Conaway and Braune, 2006; and Ferguson and Hill, 2005). Such involvement encourages dialogue and increases accountability of all stakeholders. Community empowerment to make needed changes within the community is necessary to reduce ATV related injuries and fatalities in all age groups.

The findings of this pilot study support gains in responsible ATV behavior and attitudes. Four questions (allowing young children to ride unsupervised; permitting passengers to ride along; testing driving skills to the limit and wearing long pants) did not bear statistical significance. Specifically, these pre-event, host-related behaviors represent three risky behaviors associated with ATV accidents and injuries (Cvijanovich, Cook, Mann & Dean, 2001; Rodgers & Adler, 2001; and Keenan & Bratton, 2004).

Although the measure of change in four of the attitude and behavior questions were not statistically significant, 61% of the subjects (n=11) indicated on the post-test that they would no longer allow a passenger to ride along. Regarding the question of allowing younger children to operate an ATV unsupervised, 50% indicated they "never" engaged in this behavior on the pre-test and 60% of the subjects indicated on the post-test they planned to "never" engage in this practice in the future. Likewise, 44% percent

of the subjects (n=8) indicated on the pre-test that they "never" test their ATV driving skills to the limit. Of those that indicated on the pre-test that they engaged in this behavior, 27 % of the subjects (n=5) planned to engage in this behavior less frequently as indicated on the post-test.

Plausible explanations for the pre-test findings include parental and peer influence, possible prior attendance of farm safety programs that included some ATV education, potential exposure to television or radio public safety announcements or knowledge of ATV crashes and resulting injuries that were effective in increasing awareness of these unsafe behaviors. Despite the statistical insignificance, small and pertinent changes in reported attitudes and behaviors were demonstrated and thus, may result in a preserved life or limb. Perhaps these resistant behaviors could be changed with additional training and resources for ATV instructors.

Incidentally, for this pilot study, a local ATV dealer generously loaned three age-appropriate, very sporty looking ATVs for this event and all the participants expressed a strong desire to operate one of them. The adolescents responded positively to up-to-date equipment and the hands-on training by the instructors. The instructors provided tips and other forms of instruction and provided immediate feedback to the subjects. This timely instructional intervention kept the participants motivated and engaged in the learning process. Engagement of the participants in the learning process with credible instructors and attractive, age-appropriate equipment may help empower them to break away from risky behaviors (Ferguson & Hill, 2005; McCallum, et al., 2006; and Reed, et al., 2006).

ATV injuries and fatalities are a public health concern. They are largely preventable and predictable. Prior studies have provided much information regarding risk factors and strategies to reduce them. The financial, social and personal impact of ATV crashes is significant. Through use of Haddon's Matrix, injury prevention and injury control is achievable through evaluation of the host (ATV driver), the agent (all-terrain vehicle) and the environment (physical, social and legal features) prior to an ATV crash in the pre-event, during the event and post-event phases. Improved engineering and adequate legislation that is properly enforced are important in reducing ATV crashes resulting in injuries and fatalities.

Through the literature search, identified risk factors and risky behaviors were graphed onto a grid using Haddon's Matrix. Thus, Haddon's Matrix was used systematically as a process identification tool where risk factors and risky behaviors associated with the host; the agent and the environment were visualized. The knowledge, behavior and attitude questions relevant to the host, the agent and the environment in the pre-event, event and post-event phases as identified on the Matrix grid were used in the development of the questionnaire for this pilot study.

In this study, 78% of the participants had not taken an ATV class; although 83% reported they have driven an ATV. This lack of ATV training is consistent with the Goldcamp, *et al*, 2006 study and the Burgus, n. d. study where only 22% had attended an ATV safety training class. Jones and Bleeker (2005) reported the use of an ATV greater than three times per week as a predictor of ATV-related injury. In contrast to the Aitken, et al. (2004) study, where 35% of the subjects operated an ATV more than three

times per week, this pilot study revealed that 12% of the participants operated an ATV more than three times per week. Fifty-two percent of the participants reported they use an ATV for work and recreation in the Aitken, et al (2004) study. Similarly, 50% of the participants reported use of an ATV for both work and recreation in this pilot study.

Limitations

Bias could have been introduced as the result of the adolescent participants' inability to accurately self-assess. Additionally, the participants could have provided perceived expected responses or fabricated responses instead of factual information on the self-report questionnaire. These potential effects could adversely affect the findings of this pilot study.

The small sample size and the lack of a control group represent limitations to this pilot study. Another limitation includes the researcher-developed questionnaire. As previously discussed, experts in ATV safety reviewed the questionnaires for content validity. Retrospectively the questions were analyzed for degree of difficulty. Five of the twenty knowledge questions were noted to be at the application level representing higher ordered thinking skills. For future use these questions should be modified to the knowledge or comprehension level of the target audience. The reading and comprehension level should be reduced to the fifth-grade reading level or lower (Bastable, 2003). Refinement of the questions should be followed with psychometric testing of the questionnaires.

Another limitation of the study was the weather and timing of the study. The ATV safety-training course was slated to begin at 1:00 pm on a Saturday in January.

Because the demographic questions and pre-test were administered first, the program did not start until 1:45 p.m. The ATV safety program included a one-hour didactic lecture followed with a hands-on training outdoor obstacle course. While outdoors the program director and his assistants provided additional instruction, helped the participants choose proper protective equipment, and followed the participants as they navigated around pylons for accuracy in operating an ATV. Each participant was scored on their skills and received feedback on their performance weaknesses and strengths.

The pretest was conducted in a warm and spacious well-lit room; however, the post-test was conducted outdoors immediately following the hands-on training. With the wind chill factor, the outdoor temperature was in the upper twenties. All participants waited with adult supervision and some of the participants waited outdoors two hours or longer so they would not lose their turn in line. Three of the last participants to drive the obstacle course did so at dusk. While this was less than optimal for training and evaluation of their driving skills, the participants did mention they could identify with the precautions discussed in class about dangers associated with riding in the dark.

As previously discussed, no statistical differences were detected between the knowledge pre-test and post-test data. In this pilot study, 33% of the participants (n=6) improved their post-test raw score by one point as compared to their pre-test raw score. Three of the participants (16.6%) scored two to three points better on their pre-test raw score than the post-test raw score. Similar individual results were reported in the McCallum, Conaway, Drury, Braune and Reynolds (2004) study.

One plausible reason the participants may not have performed as well on the knowledge section of the post-test is the placement of this content first on the questionnaire. The January weather-related conditions for the post-test were less than optimal. Two probable distractions existed where the participants were cold from being outdoors for a considerable length of time and most had parents waiting to take them home. It is noteworthy to add that six of the participants did not stay to complete the post-test for either or both reasons. Unfortunately, the data for these participants were deemed ineligible for use in this study.

Based on the data findings of this pilot study, one may cautiously infer that the KDA ATV safety program improved safety attitudes and future ATV behavior after exposure to a single teaching and learning experience. As previously mentioned, 78 % of the participants reported this experience to be their first ATV safety course. Nonetheless, the knowledge questions failed to demonstrate statistical significance where some subjects scored better on the pre-test than the post-test for plausible reasons as noted. The Jones & Bleeker (2005) and the McCallum, et al. (2006) studies both reported no improvement in knowledge measures. Both studies were conducted in a winter month and may be an important issue to study.

While waiting outdoors with participants, opportunities also arose to speak with some of the parents. Some of the challenges for parents are the economics of purchasing age appropriate gear and ATVs for their children (pre-event, agent related issues). One parent mentioned that a grandparent had purchased an expensive ATV that was too large for the child. The grandparent was initially unaware that the adult size was

inappropriate for the age, cognitive and motor skills of the child. So the grandparent would hold the child in his lap and ride around to entertain the child (pre-event, social environment issues). This revelation further underscores the need for ATV safety education targeted to increase parental and community awareness. This finding is consistent with previous research (McCallum, et al., 2006, and Ferguson and Hill, 2005).

Conclusions

Educational interventions using a collaborative, multidisciplinary approach with innovative and engaging teaching strategies are essential in raising ATV safety awareness. Adolescents, parents and community members who feel empowered are often motivated to gain knowledge and develop the attitudes and behaviors necessary to operate ATVs safely.

Although this pilot study failed to demonstrate a statistically significant change in knowledge, there were small yet pertinent changes. The attitude and behavior changes demonstrated statistically significant increases. It is important to note that 28 adolescents pre-registered and attended the KDA ATV safety program on a cold and blustery winter day. This finding points to the level of adolescent interest in ATV safety training in south central Kentucky. Furthermore, the data revealed 78% of the subjects had never attended an ATV safety program. This figure is consistent with the study by Burgus, (n. d.) and indicates the need for additional ATV safety programs across Kentucky.

In relation to Haddon's Matrix, seven major conclusions believed to reduce ATV-related injuries and fatalities were identified in the literature. The first two conclusions were 1) consistent use of helmets and other protective gear, and 2) the need for ATV safety training for ATV drivers of all ages (Adams, *et al*, 2004; Goldcamp, *et al*, 2006; Burgus, n. d.; and Ferguson & Hill, 2005). The third and fourth conclusions were enactment of laws restricting use of an ATV by children under the age of 16, and enforcement of current laws (Fonseca, *et al*, 2005; Humphries, *et al*, 2006; and Keenan & Bratton, 2004). The fifth conclusion was the avoidance of passengers on ATVs designed for single riders (Humphries, *et al*, 2006; and Ferguson & Hill, 2005). The sixth conclusion stressed the benefits and need for community and parental involvement in ATV safety and other farm safety practices (McCallum, *et al*, 2006; Reed, et al, 2006; and McCallum, *et al*, 2004). The final conclusion was the need to provide ATV safety instructors with training in various instructional methods and resources to conduct hands-on ATV training (Reed, et al, 2006; Jones & Bleeker, 2005; Aitken, et al, 2004; Cvijanovich, et al, 2001).

Implications for Nursing

Implications for nurses include a multidisciplinary approach to ATV safety. School, public health, and emergency nurses, nurse practitioners and nurse educators have the critical thinking and assessment skills to work collaboratively with school and agriculture teachers, members of the community, the Kentucky State Police, and the Kentucky Department of Agriculture. Nurses can contact local and state officials to develop resourceful legislative approaches to a multifaceted problem. Furthermore,

nurses have a moral and ethical responsibility to advocate for ATV safety by educating peers, legislators, individuals in their communities and society in general about needed changes in knowledge, behaviors and attitudes to prevent ATV injuries and fatalities. Despite the financial constraints associated with the current budget cuts in the Commonwealth in Kentucky, ATV safety programs should continue to be funded until the ATV related injuries and fatalities in Kentucky are greatly reduced.

Recommendations for Future Research Studies

Recommendations include conducting future studies using a variety of teaching and learning strategies to determine best practices for ATV training. Instructors should receive training and support with feedback within a reasonable period of time (Reed, et al, (2006). Including victims of ATV crashes, peer educators and hands-on training may result in authentic learning. Providing small monetary incentives, prizes or providing attractive, free or low cost helmets and other protective equipment appear to increase motivation and participation (Ferguson & Hill, 2005).

Replication with larger sample sizes, longitudinal studies, and studies including a control group with randomization will add rigor to future studies (Hartling, et al, 2004). Development of questionnaires and other measurement instruments should be subjected to psychometric testing to evaluate validity and reliability. Perhaps other outcome measurements such as reduced ATV injuries and fatalities instead of knowledge measurement would be more appropriate as suggested by Hartling, et al, 2004.

Creative and hands-on training using the Transtheoretical theory and the AgDARE model as noted by Reed and Kidd (2002) may be useful in overcoming resistance to change regarding appropriate ATV use as well as farm work behaviors of adolescents. Long-standing misconceptions about the cognitive and developmental capabilities of children are deeply ingrained in many rural families and communities. Empowering adolescents, parents and communities to action is essential to replace risky behaviors with safer practices to reduce injuries and fatalities. Replication of studies using the above theoretical approach as well as the North American Guidelines for Children's Agricultural Tasks are needed (Hartling et al., 2004).

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APPENDICES

Appendix A

INFORMED CONSENT DOCUMENT
Participation in ATV Safety Research Questionnaire

Project Title: An ATV Safety Educational Program: Is it effective in improving safety knowledge, attitudes and behaviors in adolescents ages 12 to 18?

Investigator: Kim Y. Vickous, Masters of Science in Nursing student, Western Kentucky University School of Nursing. Contact information: kim.vickous@wku.edu.

You are being asked to allow your child to participate in a research questionnaire conducted through Western Kentucky University. Your child's participation is completely voluntary and your child may attend the ATV safety training regardless of your decision. The University requires signed parental agreement (consent) for your child to complete the questionnaire.

The investigator, Kim Vickous or her designee will explain to you in detail the purpose the questionnaire, the procedures, and the potential benefits and possible risks of participation. A basic explanation of the project is written below. Please read this explanation and discuss any questions you may have with the investigator or designee. If you agree to allow your child to participate in the questionnaire, please sign on the last page of this form in the presence of the person who explained the project to you. You'll be given a copy of this form to keep.

Purpose of the Project: The purpose of this project is to determine if an ATV educational safety program (ATV program) is effective in improving safety knowledge, attitudes and behaviors in adolescents. If you consent, your child will complete a questionnaire developed to seek information regarding your child's knowledge, attitudes and behavior about ATV safety prior to and upon completion of an ATV safety-training program.

Explanation of Procedures: Inclusion requirements for participation include: 1) the ability to read and comprehend English, and 2) adolescent is between the ages of 12 and 18 on January 26, 2008, and 3) adolescent is registered for today's ATV safety-training program and 4) written parental consent and written adolescent assent. Once inclusion requirements are met, Mrs. Vickous will explain and distribute a questionnaire to individuals already registered in the ATV program. Your child will complete a questionnaire before and after attending the ATV program. Both surveys will take about 15 minutes each to complete. Upon completion of the second questionnaire, your child's participation in the study is concluded.

Benefits and Risks: An anticipated benefit includes improved adolescent awareness of personal safety knowledge, attitudes and behaviors regarding safe operation of ATVs. Potential risk to participants is minimal and related to time and mental alertness to complete the pre and post- program questionnaires.

Confidentiality: Questionnaire data is coded in such a way that the identity of individual participants cannot be detected. Questionnaire data will be stored in a locked cabinet within the School of Nursing. You may contact Mrs. Vickous after May 31, 2008 for a summary of the results; individual results will not be available. The summary may be reported or published.

Refusal/Withdrawal: Filling out the questionnaires is completely voluntary. There is no obligation to participate and refusal to participate in the questionnaires will have no effect on any future services you may be entitled to from Western Kentucky University. Your decision to refuse participation in the questionnaires will not prevent your child from participating in the ATV safety-training program. Parents who agree to allow their child to participate in the questionnaire are free to withdraw their child from the study at any time without penalty.

I understand also that it is not possible to identify all potential risks in a study of the effectiveness of an ATV Safety Training Program, and I believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks. I further understand that I may terminate consent for my child to participate in this research questionnaire at any time without penalty.

_____ _____

Signature of Parent or Legal Guardian Date/Time

_____ _____

Witness Date/Time

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY THE WESTERN KENTUCKY UNIVERSITY HUMAN SUBJECTS REVIEW BOARD

Sean Rubino, Compliance Manger

TELEPHONE: (270) 745-4652

Appendix B

Assent Form for Minor Participation in ATV Safety Research Questionnaire

I, _____, understand that my parent or legal guardian has given permission for me to participate in a questionnaire concerning safety knowledge, attitudes and behaviors of adolescents regarding use of all-terrain vehicles. I understand that I will complete a questionnaire before attending and after completing the ATV safety program. Mrs. Kim Vickous, the investigator, will keep both questionnaires in a locked file at the Western Kentucky University School of Nursing.

My participation in this questionnaire is voluntary, and I have been told and understand that I may stop my participation in the ATV research questionnaire at any time. I understand that I may attend the ATV program regardless of my decision. If I choose not to participate, there will be no penalty to my family or me.

Signature _____ Date/Time _____

Witness _____ Date /Time_____

Appendix C

For the purposes of this questionnaire, a farm is defined as a section of land used in the production and management of plants, produce or livestock. For the purposes of this questionnaire, an ATV is an all-terrain vehicle with three or four wheels and does not include gators, mules, or other utility vehicles.

Please circle your answer to the following questions.

1 Gender:
a. male
b.
female

2 What is your date of birth?
_____

3 Do you live on a farm?
a. yes
b. no

4 Do you work on a farm?
a. every day
b. 4 - 6 days a week
c. 1 - 3 days a week
d. once a month
e. during the summer months or other season of the year.
f. one time only
g. never

5 Have you ever driven an ATV?

a. yes
b. no

6 How often do you drive an ATV?

a. every day
b. 4 - 6 days a week
c. 2 - 3 days a week
d. once a week
e. once a month
f. less than once a month
g. never

7 How often are you an ATV passenger?

a. every day
b. 4 - 6 days a week
c. 2 - 3 days a week
d. once a week
e. once a month
f. less than once a month
g. never

8 For which reasons do you drive an ATV?

a. work
b. recreation
c. work and recreation
d. other reasons, such as _____

9 Have you attended an ATV training class?

a. yes
b. no

10 If you have attended an ATV training class, how long ago?

a. less than 1 year ago.
b. 1 to 2 years ago.
c. 3 to 4 years ago.
d. 5 years ago or longer.

11 How old where you when you first began to drive an ATV? _____

Appendix D

Please circle your answer to the following questions.

12 The single most important piece of riding gear is your
a. boots
b. helmet
c. gloves
d. goggles

13 For a helmet to protect you best, it must
a. be securely fastened.
b. fit loosely but not too loose.
c. follow all federal and state laws.
d. all of the above.

14 When driving an ATV, protecting your eyes
a. is not necessary.
b. with scratch free regular sunglasses is best.
c. with scratch free goggles or a face-shield is best.
d. with tinted eyeglasses is best.

15 An example of proper protective clothing should include:
a. light colored shorts and a t-shirt to stay cool in warm weather.
b. good fitting tennis shoes to protect your feet.
c. a good pair of gloves to increase grip and protect your hands.
d. all of the above.

Please circle your answer to the following questions.

16 An appropriate ATV engine size for a 12 year old is
a. under 70 cubic centimeters.
b. 70 cubic centimeters to 90 cubic centimeters.
c. over 90 cubic centimeters.
d. none of the above.

17 Females are more likely to be injured in an ATV accident.

a. true b. false

18 When performing a pre-ride inspection, you should
a. check the controls and

cables.
b. look for oil or fuel leaks.
c. shake the handlebars and footrests.
d. all of the above.

19 The first step in mounting an ATV is to set the parking brake.

a. true
b. false

20 While driving an ATV, if you cannot see what is on or over the crest of a hill, you should
a. speed up to get to the top of the hill and check the terrain carefully.
b. shift your body weight to the rear of the ATV seat to maintain balance.
c. shift to a higher gear and use your rear brake if needed.
d. slow down and check the terrain carefully before going any further.

Please circle your answer to the following questions.

21 Three to six inches is needed between the ATV seat and your inseam while standing on the foot pegs.
This is important because

a. it allows the ATV driver to stand up and absorb shocks through the body.
b. it decreases the possibility of the ATV operator being struck by the seat and thrown over the handlebars.
c. it helps the ATV driver see better.
d. all of the above.

22 A good fit between the ATV and an ATV driver include
a. the ability of the ATV driver to reach the handlebars and footpegs from the back portion of the seat comfortably.
b. the ability of the ATV driver to stand on the footpegs with one leg comfortably.
c. the ability of the ATV driver to operate the brakes with the heel of both feet comfortably.
d. the ability of the ATV driver to use the gearshift with the thumbs comfortably.

23 To test ATV tire pressure you may use a car or high pressure tire gauge.

a. true
b. false

For the purposes of this questionnaire momentum means to keep the ATV moving forward.

24 Basic turning technique for an ATV includes
a. traveling at moderate to fast speeds to maintain momentum.

b. shifting your body weight backwards on the seat.
c. traveling at low to moderate speeds.
d. shifting your body weight to the outside of the turn.

Please circle your answer to the following questions. 80

When going on an uphill climb while driving an ATV,
25 you should
a. shift the ATV to a higher gear and speed up to maintain momentum.
b. shift the ATV to a lower gear and slow down to maintain momentum .
c. shift the ATV to a lower gear and speed up to maintain momentum.
d. shift the ATV to a higher gear and slow down to maintain momentum.

According to Kentucky ATV law
26 (KRS 189.15)
a. protective headgear is not required for the ATV driver when the ATV is on public property.
b. headgear is required when engaged in farm, mining, logging or other commercial operations.
c. an ATV may be driven on any public highway or roadway as long as the operator has a valid driver's license.
d. an ATV is allowed to cross a 2 lane public highway at a 90 degree angle if practical and safe.

Environmental concerns of an ATV driver should
27 include
a. respect for the land and the

plant life.

b. altering the ATV exhaust system.
c. allowing passengers to ride along.
d. all of the above.

28 Who is the most responsible for your actions when you drive an ATV?

a. my parents
b. myself
c. my teacher
d. my grandparents

Please circle your answer to the following questions.

29 When driving downhill, it is important to

a. shift your body back on the rear of the seat, and look ahead.
b. lean your upper body uphill and keep your ATV in a straight line.

c. shift your body forward on the seat, lean forward towards the handlebars.
d. none of the above.

30 When going across the slope of a hill (traversing a hill), it is important to
a. shift your body back on the rear of the ATV seat.
b. lean your upper body weight downhill.
c. keep both feet firmly on the footrests.
d. quickly change the throttle to help the rear wheels maintain traction.

31 When riding over obstacles you should
a. stay seated on the ATV and lock your knees and elbows.
b. keep a firm grip on the handlebars and keep the ATV pointed straight ahead.
c. approach the obstacle at a walking speed and as close to a 45 degree angle as possible.
d. swerve the ATV to one side and cross over the obstacle as fast as possible .

Appendix E

Please place an X - mark on the line to tell us how often you do the following actions.

When driving an ATV, ***how often*** do you …

32	use a map and a compass.	never		always
33	scan the terrain for holes, ruts, bumps, obstacles & wildlife.	never		always
34	wear a helmet.	never		always
35	encourage your friends to wear a helmet.	never		always
36	get permission from landowners before riding on their land.	never		always
37	let someone know the route you plan to take.	never		always

Please place an X - mark on the line to tell us how often you do the following actions.

When driving an ATV, ***how often*** do you …

38	consider dangers of driving an ATV after dark.	never		always
39	let someone know when you plan to return home.	never		always
40	take frequent breaks on long rides.	never		always
41	let younger kids drive ATVs without supervision.	never		always
42	carry a vehicle repair kit.	never		always
43	allow passengers to ride along.	never		always

Please place an X - mark on the line to tell us how often you do the following actions.

When driving an ATV, ***how often*** do you wear

44	carry drinking water.	never		always
45	test your driving skills to the limit (for example jumping off ramps and wheelies).	never		always
46	helmet	never		always
47	eye protection	never		always
48	gloves	never		always
49	boots	never		always
50	long sleeves	never		always

Please place an X - mark on the line to tell us how often you do the following actions.

When driving an ATV, ***how often*** do you wear

51	long pants	never		always

Appendix F

Please place an X - mark on the line to tell us how often you plan to do the following actions.

When driving an ATV in the future, ***how often*** do you plan to …

32	use a map and a compass.	never		always
33	scan the terrain for holes, ruts, bumps, obstacles & wildlife.	never		always
34	wear a helmet.	never		always
35	encourage your friends to wear a helmet.	never		always
36	get permission from landowners before riding on their land.	never		always
37	let someone know the route you plan to take.	never		always

Please place an X - mark on the line to tell us how often you plan to do the following actions.

When driving an ATV in the future, ***how often*** do you plan to …

38	consider dangers of driving an ATV after dark.	never		always
39	let someone know when you plan to return home.	never		always
40	take frequent breaks on long rides.	never		always
41	let younger kids drive ATVs without supervision.	never		always
42	carry a vehicle repair kit.	never		always
43	allow passengers to ride along.	never		always
44	carry drinking water.	never		always

Please place an X - mark on the line to tell us how often you plan to do the following actions.

When driving an ATV in the future, ***how often*** do you plan to …

45	test your driving skills to the limit (for example jumping off ramps and wheelies).	never		always
46	a helmet	never		always
47	eye protection	never		always
48	gloves	never		always
49	boots	never		always
50	long sleeves	never		always
51	long pants	never		always