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thesis entitled

PROTECTIVE CLOTHING ACTIONS
OF MICHIGAN CORN AND APPLE GROWERS
IN REGARD TO PESTICIDES

presented by

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has been accepted towards fulfillment
of the requirements for

M.S. degree in Human Environment
and Design

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Date Jan. 27, 1986

PROTECTIVE CLOTHING ACTIONS OF MICHIGAN CORN AND APPLE GROWERS IN REGARD TO PESTICIDES

By

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Master of Science

Department of Human Environment and Design

1986

ABSTRACT

PROTECTIVE CLOTHING ACTIONS
OF MICHIGAN CORN AND APPLE GROWERS
IN REGARD TO PESTICIDES

by

Lois C. Shern

Two hundred twenty-two Michigan growers who applied pesticides in the past two years completed usable self-administered questionnaires.

The objectives of this study were to: 1) gather baseline data about selection, storage, and wearing practices for pesticide soiled clothing, 2) determine if corn and apple growers differ with respect to selected demographic, clothing, and experience variables, and 3) explore a model which explains protective actions with respect to clothing.

Data were analyzed using Pearson Product Moment correlations, two-tailed independent t-tests, principal components factor analysis, and various descriptive statistics.

The following conclusions were made:

Regular clothing, not protective, is worn by both corn and apple pesticide applicators. Storage and laundry actions for pesticide soiled clothing are similar but differences were found in regard to experience and protective health actions.

Significant correlations were found among the variables which represent dimensions of the Model to Predict Protective Health Actions. A profile of two types of pesticide applicators, the risk taker and the risk avoider, emerged from data analysis.

ACKNOWLEDGMENTS

The author wishes to acknowledge the support and encouragement which has been provided by several special individuals throughout this undertaking.

Special thanks to Dr. Ann C. Slocum, advisor and friend, as well as chairperson of my committee, for her encouragement, interest, and continual assistance.

To Dr. Brenda Sternquist, Dr. George Ayers, and Irene Hathaway, committee members, for their interest and suggestions.

To Judy Pfaff, computer and statistical consultant, for her special efforts in finding lost data.

To Deborah Johnson, friend and proofreader, for her willingness to read and critique this manuscript.

And especially to my family for their patience, support, and love throughout this endeavor.

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CHAPTER I

INTRODUCTION

Families, as part of a societal ecosystem, are inextricably linked to a variety of environmental systems-social and physical, natural and institutional. American farm families numbered approximately 3 million in 1984 (Block, 1984). However, over 22 million people work in some phase of agriculture. Agriculture is essential to the well-being of our nation - both nutritionally and economically. In 1983, 65,000 Michigan farms produced crops that totaled over $3 billion worth of production (Ferris, 1984). Weather and pests are a constant threat to agricultural production. Pests destroy approximately thirty percent of annual production before farmers can bring their crops to harvest or livestock to slaughter (Block, 1984). The use of pesticides has become an integral part of farming today.

Farmers are the biggest users of pesticides. Total pesticide usage in the U.S. has nearly doubled since the 1960's. Agricultural use has nearly tripled since 1964 (EPA, 1984). However, 1982 was the first year in recent times when pesticide use in American agriculture declined.

The benefits of these chemicals have not been without costs. Toxic chemicals have caused damage to both the environment and to public health. Knowledge about pesticides and pesticide safety practices is not only of great importance to those who work directly with these chemicals but also to other members of the family and the community.

The wise use of pesticides and other toxic chemicals is essential for modern agriculture production and public health. Beginning with the discovery of DDT and other chemicals during World War II, agricultural productivity has been enhanced and the incidence of yellow fever, malaria, and other illnesses has been greatly reduced. However, mounting evidence of the dangers of pesticides and growing public awareness and concern about environmental pollution from toxic chemicals make it imperative that more is learned about pesticide contamination. The lack of selectivity of pesticides and their widespread overuse are causing immense problems for agriculture itself.

Over the past seven years many health related cases have been acted upon by EPA scientists and the Pesticide Science Advisory Panel. According to the World Health Organization, parathion poisoning is the major cause of the estimated 500,000 human illnesses and 20,000 deaths that occur worldwide each year from the use of pesticides (Metcalf, 1984). Many people believe that pesticides are among the worst of the environmental pollutants (Carson, 1962; Epstein, 1979; Boraiko, 1980). The Council for Environmental Quality, in a public survey in 1980, found that the level of public concern about toxic chemical wastes surpasses that for any other environmental problem (Metcalf, 1984)

Statement of the Problem

For the farmer, the acceptability of the risk related to pesticide application is positively associated with large-scale benefits and the potential for sizable accidents (Vlek and Stallen, 1981). Knowledge about pesticides and their long-term effect is still fragmentary. Long-term health risks for the pesticide applicator, his family and the general community are unknown. Many of the symptoms of pesticide poisoning are similar to other illnesses. Nausea, diarrhea, rash, headaches, and eye irritations can be symptoms of low-level pesticide poisoning but may be attributed to other sources of illness.

While few Americans want to return to fleas, bedbugs, or the wormy apples of the 18th century it is essential that the risks of pesticides are explored and controlled. The issue of risk/benefit has become the focal point of the pesticide controversy.

Edwin Johnson, Director of EPA's Office of Pesticide Programs, has stated

> pesticides by their very nature are designed to be biologically active and kill pests and weeds, (so) we speak in terms of relative risks, rather than 'safety'. Much of the debate about pesticides centers on this issue. To the extent that some people focus on the risks only, and are not cognizant of the benefits' side of the equation, the risks can be overexaggerated (Johnson, 1984, p. 6).

Last year, an estimated 82 million people were added to the world's population. It is predicted that the world will have to produce more food and fiber in the next fifty years than in all previous human history (Barr, 1984).

The editor of the National Geographic magazine contends that

> with a steadily expanding population and a decrease in arable land, the world must use pesticides to maintain high crop yields and affordable food. At the moment there is simply no other way to farm on the scale required (Boraiko, 1980, p.145).

For many people involved on a day to day basis with pesticides, the acceptability of risk depends on the amount of the benefit to be received for taking the risk. The need to produce food for the hungry of the world challenges agriculture to recognize the mutual dependencies of the environment, economics, and human health.

Davies (1976) found that occupational exposure to pesticides (this includes workers who manufacture, formulate, transport, mix and dispose of pesticides) is greatest to those individuals who apply pesticides to agricultural crops utilizing a variety of spraying and dusting equipment. While 1982 showed a slight decline in agricultural pesticide use, the pesticide industry remained relatively stable when compared to manufacfurers of machinery and fertilizer. The fact that pesticide use declined only modestly while pesticide prices increased and operating costs sky rocketed is attributed to farmers' reluctance to risk increased crop losses (Farmline, 1983). The individuals who are most at risk, also perceive the benefits of using pesticides.

Pesticide exposure is related to the type of activity, method of application, concentration and formulation of the particular chemical, and environmental conditions, primarily wind velocity. The particular chemical used varies with the type of crop to which it is being applied and the particular pest for which it is most effective. Michigan apple growers apply several different insecticides at various times during the entire growing season, usually as spray. Corn insecticides are usually applied in a granular formulation prior to or at planting. Virtually all corn acreage is treated with herbicides.

Federal regulations require that pesticides be labeled according to their toxicity and health effects.

State extension services have developed programs to keep the agricultural community informed about safety. Applicators are required to be licensed in order to use chemicals which are on the EPA restricted list.

A great deal of research has concentrated on determining the major routes of exposure to humans. These are: (1) inhalation, (2) ingestion, and (3) skin absorption. Researchers have compared the dermal and respiratory routes and have determined that 87% of the total human exposure is accounted for by dermal exposure (Durham, 1962; Maibach, Feldmann, Milby, & Sert, 1971). Maibach and his co-workers at the University of California School of Medicine were able to chart the rates at which pesticide residue was absorbed through the skin. Absorption rates ranged from 8.6% for the forearm to 100% for the scrotum. Research at Michigan State University (DeJonge, Ayers, & Branson, unpublished) identified spray deposition patterns on clothing of agricultural workers who were driving tractors and using high and low volume spray equipment. Utilizing the absorption data from Maiback, Michigan's study showed that special care should be taken to protect the scalp, ear canal and forehead, as well as the abdominal and waistline area.

The use of protective clothing has emerged as a viable method of safety protection. Protective clothing was classified as safety equipment in the 1982 Crop and Livestock Pesticide Usage Survey by the U.S. Department of Agriculture. Gloves, long-sleeved shirts, and masks are examples of safety equipment listed in the survey. More than sixty percent of the 6,520 respondents reported using the more common safety equipment (gloves, long-sleeved shirts, and caps). Fifteen percent used specialized safety equipment (dust mask, face shield or goggles), but five percent reported using no pesticide safety equipment of any kind when mixing, loading, or applying pesticides.

However, it is only in recent years that research has begun to address the complicated issue of pesticide contaminated clothing. New disposable fabrics and garments are being developed but the safety of laundered garments is still undetermined. Little is known about the storage and laundry procedures used for pesticide soiled clothing.

Scope of the Study

This study is part of North Central Region Project 170, "Limiting Pesticide Exposure Through Textile Cleaning Procedures and Selection of Clothing", for which the author is a graduate research assistant. The overall purpose of the larger (regional) study is two-fold: 1) Survey agricultural growers to learn what selection, use, and care practices are currently used for pesticide contaminated clothing and 2) Perform laboratory studies which will determine the best methods for removal of pesticide residue from fabrics. Five states are participating in the survey portion of the regional study. This present study will utilize only the Michigan portion of the survey data.

Objectives

The objectives of this study are to:

1. Gather baseline information about applicators' selection, storage, and wearing practices for pesticide soiled clothing.
2. Determine if there are differences between corn and apple growers with respect to demographic variables, experience and use of pesticides, clothing and laundry practices, and toxicity and formulation of pesticides that are reported to get on clothing which is worn while applying pesticides.
3. Explore a model which explains actions taken with respect to pesticide soiled clothing.

Research Questions and Hypotheses

The research questions and hypotheses in the null form are:

Questions for Objective 1

1. What kind of clothing do pesticide applicators wear when applying pesticides?

2. How is pesticide soiled clothing stored before laundering?

3. What kind of actions do corn and apple growers engage in when clothing becomes soiled with pesticides?

Questions and Hypotheses for Objective 2

1. Are there differences between corn and apple growers?

H1: There will be no significant difference between the mean ages of corn and apple growers.

H2: There will be no significant difference between the mean years of education of corn and apple growers.

H3: There will be no significant difference between the mean incomes of corn and apple growers.

H4: There will be no significant difference between the mean family size of corn and apple growers.

H5: There will be no significant difference between the mean ages of the youngest child living at home under 18 years for corn and apple growers.

H6: There will be no significant difference between the mean number of years individual corn and apple growers have been applying pesticides.

H7: There will be no significant difference between the mean number of days per year that individual corn and apple growers apply pesticides.

H8: There will be no significant difference between the toxicity of pesticides used by corn and apple growers.

H9: There will be no significant difference between corn and apple growers regarding the kind of clothing that is worn to apply pesticides.

H10: There will be no significant difference between the storage practices for pesticide soiled clothing of corn and apple growers.

H11: There will be no significant difference in the toxicity of the pesticide that gets on clothing worn by corn and apple growers.

H12: There will be no significant difference in the time reported by corn and apple growers for changing non-waterproof clothing after spilling full strength liquid concentrate on themselves.

H13: There will be no significant difference in the time reported by corn and apple growers for changing non-waterproof clothing that has been saturated with pesticide spray.

<u>Questions and Hypotheses for Objective 3</u>

1. Do components of the Protective Health Action Model help predict the likelihood of protective clothing actions for pesticide applicators?

H1: Among pesticide applicators the variables that comprise general health behavior will not be significantly related to protective health actions.

H2: Among pesticide applicators the variables that comprise perception of risk will not be significantly related to protective health actions.

H3: Among pesticide applicators the variables that comprise perceived benefits will not be significantly related to protective health actions.

H4: Among pesticide applicators the variables that comprise perceived barriers will not be significantly related to protective health actions.

H5: Among pesticide applicators modifying and enabling factors will not be significantly related to protective health actions.

Limitations of the Study

Michigan farmers, as a group, are continually being surveyed. Agricultural experts at Michigan State University advised that a response rate of 15% to 20% is considered good in a Michigan agricultural mail survey. The length of the questionnaire (18 pages) is also considered a limitation. Farmers will often not take the time to fill out many pages of questions.

Michigan farmers are also very sensitive concerning the issue of pesticides and regulations. There is fear that regulations concerning protective clothing may be introduced. This fear may prompt the respondents to leave questions unanswered or bias the answers. It is hoped that, by assuring confidentially, respondents will feel free to give their unrestrained responses. It is also hoped that the importance of the subject will overcome objections to completing the questionnaire.

The questionnaire is part of a regional study. The primary objective of the questionnaire, used by each of the five states, was to collect descriptive data about pesticide soiled clothing. It was not designed to specifically explore a behavioral model. Therefore, the questionnaire does not directly address all aspects of the model. This will result in a limited representation of some aspects of the model.

CHAPTER II

REVIEW OF LITERATURE

The review of literature is organized in five sections. The first section discusses the emergence of clothing as a means of pesticide protection and reviews research concerning protective apparel for pesticide users. The second section reviews studies that have looked at perceived risk of pesticide use as it relates to attitudes and practices of pesticide users. The third section reviews selected studies relating to risk, the fourth section defines health protective behavior, and the fifth section traces the historic development and modification of the Health Belief Model.

The Use of Clothing for Pesticide Protection

The use of protective clothing has emerged as a major, realistic strategy to managing safety for workers using pesticides. After much debate among regulatory agencies, growers, manufacturers, researchers, and the general public, worker protection standards were adopted on May 10, 1974. These standards, which are still in effect today, include "at least a hat or other suitable head covering, a long sleeved shirt and long legged trousers or a coverall type garment (all of closely woven fabric covering the body, including arms and legs), shoes and socks (Federal Register, May 10, 1974). The North Dakota Extension Service (1983) recommends that protective clothing include: coveralls or long-sleeved shirt and pants, waterproof gloves, waterproof boots, waterproof hat with wide brim and/or a light-weight raincoat or waterproof apron. Occupational Safety and Health Administration Standard 1910.267a (1973) suggests that protective clothing include a washable fabric. Information concerning the laundering of pesticide soiled clothing has been complied by Nebraska (1984) and Iowa (1983) Extension Services. These recommendations include using hot water of at least 60 C and a heavy duty liquid detergent. Drying clothes on a line, rather than in a dryer is also recommended.

There are four major routes of entry of pesticide into the body: 1) oral, 2) respiratory, 3) dermal via intact skin and 4) through cuts and abrasions in the skin (Maibach et al., 1971; Davies, 1976; Dedek, 1982). Dermal absorption can normally be expected to be controlled by the use of protective clothing but there is evidence that such clothing, as well as clothing worn beneath the protective clothing (Finley, Graves, Summers, and Morris, 1977), can be contaminated by pesticides (Finley and Rogillio, 1969). Traditional worker garments such as denim pants and cotton chambray shirts offer limited protection (Orlando et al.,1981).

The focus of recent research has been directed toward the ability of fabric to prevent penetration of pesticides (Freed, Davies, Peters and Parveen, 1980; Orlando et al., 1981; Serat et al., 1982) and the removal of contamination from fabric through laundering (Finley et al., 1969, 1974, 1977, 1979; Easley et al., 1981, 1982; Easter, 1982). Other work has shown that, once contaminated, clothing in a pesticide applicators' wardrobe is difficult to decontaminate through the usual, accepted laundry procedures (Finley et al., 1977; Easley et al., 1981, 1982; Laughlin et al., 1981; Kim, et al., 1982). These researchers found that laundering greatly reduces the amount of pesticide residues present but even ten launderings may not be effective in removing all residue, especially if the original spill was a concentrate. Laundering also spreads the remaining pesticide throughout the entire garment. Bioassay has shown that residue remaining after repeated launderings was biologically active (Finley, et al., 1974, 1979; Easley et al., 1982). Finley and associates (1974) found that pesticide was transferred to other "clean" fabrics during laundering with pesticide soiled fabrics. Easley (1981) confirmed that insecticide contamination of the washing apparatus also occurred.

Pesticide Risk - Attitudes and Practices

Very little information is available in the literature about the relationship between perceived risk of pesticide use and attitudes and practices. Henry (1980) and DeJonge et al., (1983-84) explored attitudes, perceptions and practices of farmers concerning protective clothing. They found that protection was the only attitude that related to action or behavior. Carlson (1982) looked at fear appeal as a means of persuasion to adopt protective clothing. Fear appeal was significantly related to change in perception of hazard, benefits of protective clothing, and intentions for future use. Reported behavior was not significantly related to the fear appeal. Rucker (1983, unpublished) found that in response to questions about exposure, most applicators perceived that pesticides were frequently deposited on their clothing but were much less likely to believe that these chemicals get through to their skin. The respondents were knowledgeable about the actual toxicity level of the pesticides that were being used but were likely to express agreement with the statement that "the risk of getting pesticides on clothes is nothing compared to breathing air pollution". Wolfe and his associates (1967) reported that considerably lower exposure to pesticides was sustained by a careful operator than a careless one.

Risk - A Definition

In a recent survey commissioned by the Marsh & McLennan Companies, insurance brokers, and conducted by Louis Harris and Associates, most Americans believe they are facing considerably more risk now than they did 20 years ago. The survey reported that people expect the risk of living in a technological society will increase but that the future benefits from science and technological innovation still outweigh the risks (Management Review, 1980).

Risk is usually thought of as the probability of an undesired occurrence, eg. an automobile accident (Otway and Pahner, 1976). Risk assessment deals with the potential risks that a product, such as a pesticide, may pose to humans or wildlife. Risk management takes all factors into consideration; risk of harm, benefits to society, and the alternatives for reducing risk (Johnson, 1984).

Otway and Pahner (1976) described risk situations as being characterized by several levels:

1. physical, biological risks to man and the environment;
2. the perception of these risks by individuals;
3. the potential risk to the psychological well-being of individuals based upon perceptions;
4. the risks to social structures and cultural values as influenced by the collective psychological states of individuals.

The awareness that pesticides pose a risk to health and the knowledge that protective clothing provides a barrier to pesticides should lead pesticide applicators to display protective health behavior. However, many applicators view the health related issues of pesticide application as a future risk (Calabresi, 1970).

Health Protective Behavior

The classic definition of health behavior was formulated by Kasl and Cobb (1966). They defined health behavior as "any activity undertaken by a person believing himself to be healthy, for the purpose of preventing disease or detecting it in an asymptomatic stage." Health behavior is distinguished from illness and sick-role behaviors. Harris and Guten (1979) have expanded this definition to include behaviors which are self-defined health-protective actions. These behaviors may not necessarily be medically defined health behavior. Health-Protective Behaviors are conceptually defined as:

> any behavior performed by a person, regardless of his or her perceived or actual health status, in order to protect, promote, or maintain his or her health, whether or not such behavior is objectively effective toward that end (Harris and Guten, 1979, p. 18).

This definition implies that a behavior is performed in relation to an individual's perceptions of that behavior's health-protective potential. Consequently wearing protective clothing while spraying pesticides or taking special precautions while laundering pesticide soiled clothing should reflect the belief that these actions will provide protection. Suchman (1967) used the degree of acceptance of a protective glove as an indicator of worker willingness to adopt preventive practices for reducing accidents.

Knutson observes in his book _The Individual, Society, and Health Behavior_ that

> health behavior seems so inseparably linked to motivation that logic impels one to orient any discussion of health practices to human needs and human motives (Knutson, 1965, p. 32).

Atkinson (1966) has applied "value-expectancy theory," which describes behavior or decision making under uncertainty, to the area of achievement. He specifies that (a) motivation is needed to achieve success or to avoid failure, (b) there is an incentive value connected to a specific goal, and (c) there is the expectation of a successful outcome. This theory of motivation, based upon an approach drawn mainly from Lewin (1935), underlies the Health Belief Model.

The Health Belief Model

The Health Belief Model (HBM) is a theoretical model used to account for health-related behaviors. Initially formulated by Rosenstock and his associates

(1966), the model (Fig. 1) viewed protective health action as likely to be performed by persons who (1) feel threatened by a disease (perceive themselves susceptible to it and perceive its consequences to be severe), (2) perceive the benefits of preventive action to outweigh it costs, and (3) are exposed to some behavioral cues to action. This model was constructed to predict "preventive" health behavior such as tuberculosis and Papanicolaou screening tests, immunizations, and annual checkups.

The original Health Belief Model dealt only with the negative aspect of health - some threat of a disease or pathological condition (Becker et al., 1972). It also did not consider a person's experience in conjunction with his beliefs in its predictions or socioeconomic information about an individual (Gochman, 1972). Rosenstock and his associates (1974) viewed demographic, socio-psychological, and structural variables as serving to condition both individual perceptions and the perceived benefits of preventive actions.

Evidence suggests that there is an association between health behavior and indicators of socioeconomic status. Suchman (1965) found demographic factors (i.e., sex, age, and social class) and group social structure to be significantly related to an individual's medical orientation. Mechanic (1968) found that persons of

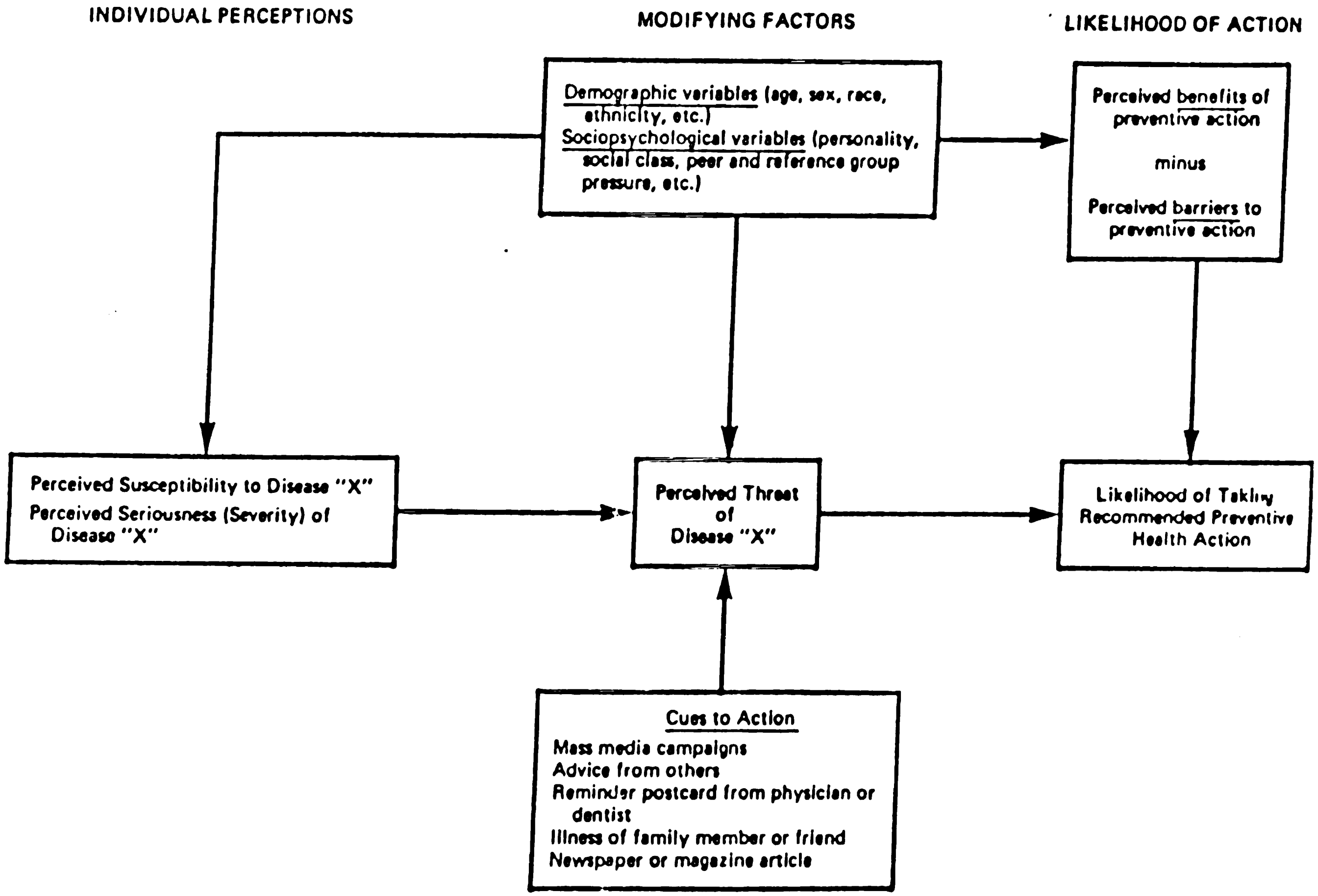


Fig. 1. Original Health Belief Model (Becker et al., 1977).

higher socioeconomic status are more likely to engage in preventive health behavior. Steele and McBroom (1972) reported that the degree of preventive health behavior is in part a function of one's socioeconomic status. Availability of health services, distance from a health provider, as well as recent illness, also influenced health related actions. Coburn and Pope (1974), in analysis of nine demographic and socio-psychological correlates of preventive health behavior, found socioeconomic status (SES) to be the most important predictor variable (followed by age). Socioeconomic status included education, income, and occupational status. Maiman et al., (1982) found that income and education levels are related to the types of medicines and medical appliances that mothers use to treat various health problems of their children.

Becker and his associates (1972, 1974, 1975), through a series of investigations formulated the model to show that individual social, psychological, and situational variables all enter into the choice or likelihood of action. Kirscht (1974) proposed that judgments about variables in the HBM are presumably made on continuous scales and are integrated according to a multiplicative rule to produce health-related action. A change in any variable should result in a change in health decisions and behavior. Further testing of the model was done to assess the construct validity of the Health Belief Model.

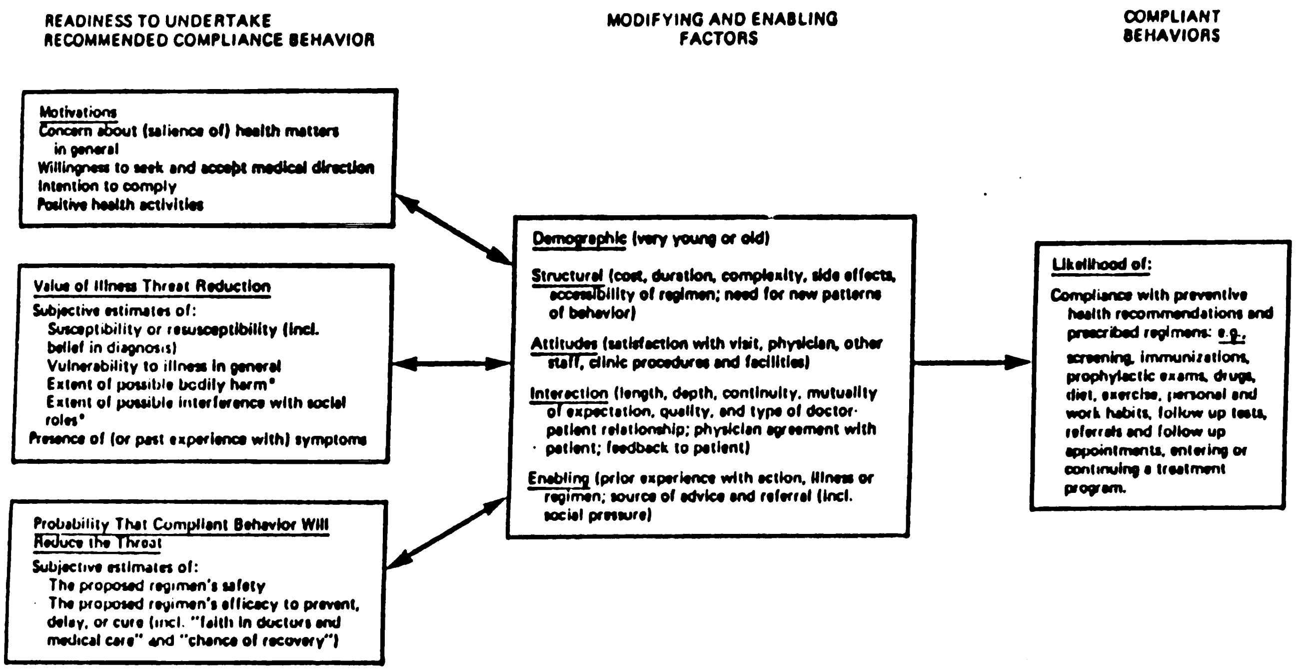
Cummings, Jette, and Rosenstock (1978) found that the HBM variables can be measured with a substantial amount of convergent validity using Likert or multiple choice questionnaire items. Evidence from this study suggests that perceptions of barriers and benefits are quite different from perceptions of susceptibility and severity. Perceptions of susceptibility and severity were found to be substantially, but not entirely, independent. A strong negative relationship was found to exist between perceived benefits and barriers. This suggests the possibility that benefits and barriers may represent opposite ends of a single continuum and not separate health beliefs.

Janz and Becker (1984), in their comprehensive review of the past ten years of HBM-related research, created a "significance ratio" which they used to order the HBM dimensions which were examined in 29 studies. The ratio was computed by dividing the number of positive and statistically significant finds for a HBM dimension by the total number of studies which reported significance levels (either positive or negative) for that dimension. The barriers dimension was rated at 91%, benefits at 81%, and susceptibility at 77%. These three dimensions were consistently associated with outcomes (behaviors). Severity (59%) was rated lowest among the dimensions of the HBM. It produced significant results in only about one-third of 29 studies. This ordering of the dimensions was true for both prospective and retrospective study designs.

When 46 pre-and post-1974 studies were combined each HBM dimension was shown to be significantly associated with the health-related behaviors studied; these include actions taken to avoid illness or injury, actions taken after diagnosis of a medical problem, and clinic visits. The significance-ratio orderings were barriers (89%), susceptibility (81%), benefits (78%) and severity (65%).

Janz and Becker suggest that the low power of the perceived severity dimension may be a reflection of its lack of importance in preventive health behavior. However, they suggest that this dimension may be of great importance to an individual with diagnosed illness.

A refined HBM model (Fig. 2) which incorporates three broad classes of variables has been utilized in the research of Fisher, 1977; Katatsky, 1977; Langlie, 1977; Becker et al., 1977, 1978; Radius et al., 1978; and Rundall and Wheeler 1979; Leavitt, 1979. These variable classes include the extent of the individual's readiness to undertake recommended behaviors, various modifying or enabling factors, and the extent of



*At motivating, but not inhibiting, levels.

Fig. 2. Summary hypothesized model for explaining and predicting health-related behaviors (Becker et al., 1977).

compliance with recommended behavior. The operational definitions of the variables have been different in every study. However, within each broad class are several dimensions which have been consistently used.

Readiness to Undertake Recommended Compliant Behavior may include: 1) the individual's general motivations with regard to health care; 2) the individual's view of his/her own vulnerability to the perceived illness threat and one's belief's about the severity of the illness defined either in terms of physical harm or interference with social functioning and 3) perception of benefits associated with actions to reduce the level of threat or vulnerability and evaluation of potential barriers associated with the proposed action which can be physical, psychological or financial (perceived benefits vs barriers).

Modifying or Enabling Factors can include behavioral cues to action, ie. previous illness, and a set of demographic, structural, and social psychological factors.

Compliance with Recommended Behavior has been expanded to account for many types of health-related behaviors such as dental check-ups and adoption of birth control methods. The original HBM included only recommended preventive health actions (TB screening tests, polio shots).

As currently formulated, the Health Belief Model views health-related behaviors as likely to be performed by persons who 1) are motivated to perform them, 2) perceive a value in reducing the threat of disease, and 3) believe that health action will reduce this threat (Harris and Guten, 1979).

Theoretical Framework

The theoretical framework for this study is based primarily on the Health Belief Model. The earliest formulation of the Health Belief Model (Rosenstock, 1966) stated that in order for an individual to take action to avoid a disease one would have to believe that (1) one was personally susceptible to it, (2) that occurrence of the disease would have at least moderate severity on some component of one's life, and (3) pursing a particular action would be beneficial in reducing the threat and the barriers to this action would not be insurmountable. An underlying assumption of the HBM is that "good health" is highly valued and a goal for most individuals.

The Health Belief Model is a psychosocial model that relates an individual's decisions about preventive health behavior to psychological theories of decision making which attempt to explain action in a choice decision. The HBM theorizes that modification in beliefs and attitudes is necessary for change to occur in one's behavior. The HBM analyzes an individual's motivation to act as a function of the expectancy of goal attainment in the area of health behavior (Maiman and Becker, 1974).

The Health Belief Model was chosen as a conceptual framework because it is based firmly on social psychological theory, relies heavily on motivational and cognitive factors and has a growing body of research that supports the Model's explanatory capability. While few studies have operationalized the variables in the same way, the dimensions have remained predictive despite the different measures.

The original Health Belief Model (Fig. 1, p. 21) was used by Murray (1982) to explore the perception of health risk of Michigan apple growers. This study proposed that the health preventive viewpoint is one of the strongest incentives to purchase and use protective garments. Results of the data analysis reported a positive relationship between perception of health risk and their willingness to use spray garments.

The three broad classes of variables which comprise the current (Fig. 2, p. 25) Health Belief Model (readiness to undertake recommended compliant behavior, modifying and enabling factors, and compliant behaviors) have been adapted by the writer to reflect protective health actions as related to clothing actions.

The four major dimensions of the HBM (susceptibility, seriousness, barriers, and benefits) are addressed. Various additions and modifications have been made to tailor the model to pesticide application and actions related to protective clothing. Figure 3 summarizes the model proposed to be tested in this study.

Theoretical Definitions

This section includes theoretical definitions of concepts relevant to the model proposed for this study.

1. Readiness to Undertake Protective Health Action

An individual's subjective state of "readiness to take action" relative to a particular health related activity. It is composed of the following dimensions.

General Health Care Motivation - An individual's overall general concern about health matters. The interacting variables identify basic perceptions about general concern for one's health and in this instance, safety when using pesticides. This concern can be reflected in a willingness to engage in positive health activities.

Perception of Risk - This term refers to the interaction of three dimensions: susceptibility, seriousness and objective experience. The perception of risk is based

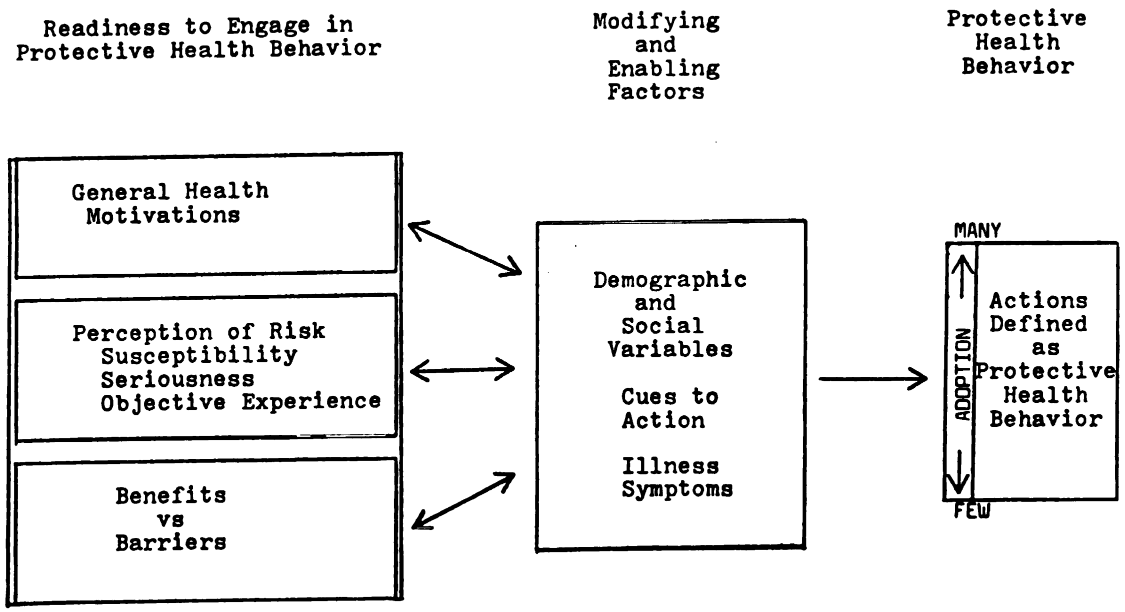


Fig. 3. A Model to Predict Protective Health Actions.

upon an individual's perceived likelihood of being susceptible to an illness or vulnerable to disease in general, the perception of the seriousness of the illness that may affect one physically or socially, and objective experience which may reinforce individual perceptions of risk and danger. Seriousness and susceptibility are terms originally used by Rosenstock and are still applicable to ideas presented in recent works. Objective experience is broader than that cited in the review of literature which limited experience to symptoms. In the case of pesticide application other knowledge and experience seem equally relevant.

Benefits vs Barriers - An individual's belief that a specific action, in this case actions relative to clothing, will reduce the threat of illness weighed against the perceptions of physical, financial, and psychological barriers to the action.

2. Modifying and Enabling Factors

These factors include demographic and enabling variables that might, in any given instance, interact in the decision-making process and influence the choice of protective health actions.

3. Protective Health Actions

These are actions that reflect protective health behavior.

Operational Definitions

The following operational definitions were established in order to define the variables used in this study. The number appearing after each item refers to the questionnaire in Appendix A.

Model to Predict Protective Health Actions Related to Pesticides and Clothing. A model, based on the Health Belief Model, which attempts to identify variables which influence an individual's adoption of protective actions related to clothing and pesticide safety (Fig.3, p. 30).

Readiness to Take Action. The interaction of three broad variable classes: General Health Motivations, Perception of Risk, and Benefits vs Barriers. The interaction of these variables will result in some protective health action.

General Health Motivations is made up of the following statements selected from the questionnaire to represent perceptions of general concern for one's health and safety when using pesticides.

1) People really can't avoid getting pesticide on their clothes if they farm nowadays. (Q-30)
2) Insecticide should be used only when monitoring the insects indicates it is needed. (Q-31)

3) People should never go into the house wearing clothes that have pesticide on them. (Q-32)
4) Pesticides are not harmful if they are handled properly. (Q-33)
5) It is better to pay someone else to apply pesticide and avoid the health risk. (Q-37)
6) Risks are just part of the job in pesticide application. (Q-38)

Perception of Risk is comprised of three dimensions: A) Susceptibility, B) Seriousness, and C) Objective Experience.

A) Susceptibility to pesticide related illness is indicated by responses to the following indicators:

1) How often would you say pesticide gets on your clothes? (Q-9)
2) When pesticide gets on your clothes, how often does it get through the clothing to the skin? (Q-10)
3) How effective do you feel the clothes you usually wear are in protecting you from pesticide exposure? (Q-18)
4) How likely is it that getting pesticides on your skin will cause immediate health risk? (Q-19)
5) How likely is it that getting pesticides on your skin will cause long-term harm? (Q-21)
6) Clothes keep pesticide off the skin. (Q-27)
7) Most people are tough enough to take exposure to pesticides without harm. (Q-29)
8) The risk involved in getting pesticide on clothes is nothing compared to breathing pollution in the air. (Q-36)

B) Seriousness is measured by the individual's responses to:

1) How serious do you think that immediate health risk is apt to be? (Q-20)
2) How serious do you think that long-term harm is apt to be? (Q-22)

C) Objective Experience includes:

1) Years of pesticide use. (Q-2)
2) Number of days per year using pesticides. (Q-3)
3) Toxicity of insecticides used most in the past two years. (Q-5)
4) Toxicity of other pesticides used most in the past two years. (Q-6)
5) The toxicity of the pesticide that most often gets on the clothes. (Q-7)

Perceived Benefits vs Barriers are measured by the attitudes and practices related to pesticide use in the following statements.

Perceived Benefits:

1) Overall, for you personally, how would you rate the crop yield benefit associated with pesticide application? (Q-26)
2) The benefits of pesticides far exceed whatever risks may be involved. (Q-35)

Perceived Barriers:

1) Overall, for you personally, how would you rate the health risk associated with pesticide application? (Q-26)
2) There are lots of things on the farm that are far more dangerous than pesticides. (Q-34)

Modifying and Enabling Factors are mediating variables. In this study the following demographic and health related variables have been chosen as likely to influence Readiness to Take Action and Protective Health Behavior.

1) Age at the beginning of the study. (Q-39)
2) Level of education reported in the study. (Q-40)
3) Income for the previous year. (Q-42)
4) Number of current household members.(Q-39)

5) Age of youngest child living at home. (Q-39)
6) Symptoms of pesticide poisoning. (Q-23)
7) Health problems that have necessitated an end to pesticide usage. (Q-24)

Protective Health Actions are indicated by the following measures:

1) Wearing protective clothing. This includes coveralls or long-sleeved shirt and pants, shoes, socks, and head covering or any clothing that offers a degree of protection from pesticides. (Q-11)
2) The length of time that pesticide soiled clothing is worn before laundering. (Q-13)
3) How soon clothing is changed after spilling liquid concentrate on the clothing. (Q-15)
4) How soon clothing is changed after becoming saturated with pesticide spray.
5) Storage of soiled clothing separate from the family laundry. (Q-16)

Other operational definitions important to the study are:

Pesticides. Any of the various substances used to kill harmful weeds (herbicides), fungi (fungicides), insects (insecticides), and rodents (rodenticides).

Toxicity. This refers to the level of toxicity of a pesticide determined by using the signal words (danger, warning, caution) that appear on the product label.

CHAPTER III

METHODOLOGY

This study is part of North Central Region Project 170, "Limiting Pesticide Exposure Through Textile Cleaning Procedures and Selection of Clothing." The Michigan project is directed by Dr. Ann C. Slocum in the Department of Human Environment and Design. It is funded by the Michigan State University Agricultural Experiment Station. Five states participated in the survey part of the regional project. The survey was designed to determine current selection, use, and care practices for pesticide contaminated clothing.

Description of the Instrument

A self-administered questionnaire was developed for use as the data collection instrument. Pilot studies were done during 1982 in Iowa and California to pretest the questionnaire which would be used by all five states participating in the regional survey project. An evaluation of the prototype questionnaire was carried out in Michigan during the summer of 1983. Fifteen MSU College Week participants completed the trial questionnaire and the questionnaire evaluation forms.

Throughout the fall of 1983 research teams from the five states worked together to produce a revised instrument which was ready to be mailed in February 1984. A basic set of questions and the same questionnaire format was used in all five states.

The final questionnaire consisted of two sections. The first section was directed to the adult in the household who applies pesticides most often and the second section was to be completed by the adult who usually does the laundry. The pesticide applicator was asked to respond to forty-two questions. The launderer answered thirty-six questions. Respondents were asked to describe the kind of pesticides most frequently used, types of clothing worn when applying pesticides, storage practices and cleaning procedures for pesticide soiled clothing, attitudes about pesticides use and protection, and demographic variables. For this study only the pesticide applicator section of the survey is being used (Appendix A).

A cover letter, which was written on the inside of the front page of the questionnaire booklet, invited the grower to participate in the study. The project was briefly described and respondent confidentiality was assured. A phone number was listed so that participants could call to confirm the legitimacy of the survey. Participants were asked to return the blank questionnaire if no one in the family had used pesticides in the last two years. Booklet return was simplified by the use of the business reply mail system.

Data Collection

Six hundred and fifty Michigan farm families were selected from Michigan agricultural producers who reported at least $1000 in farm produce sales for the fiscal year 1982. Using a systematic random sampling design from two lists, 150 apple growers and 500 corn growers were chosen to receive questionnaires. The number of growers in each sample was proportional to the total number of growers on each list.

The initial mailing of the survey questionnaire was made in late February, 1984. Approximately three weeks later a second request-reminder was mailed to nonrespondents. Participants were encouraged to call if they had any questions about the project. Thirty-one phone calls were received. A third letter containing a return postcard was mailed approximately two weeks later to those who had not responded to the second letter. Several completed booklets were received in plastic bags due to rough handling at the post office. Total response for the survey was 366, 57.4% were corn growers and 52.7% were apple growers. However, 30% and 48%, respectively, were useable (Table 1).

Table 1.--Survey Response Rate.

Category of Response	Growers Corn n	%	Apple n	%
Eligible	150	30.0	72	48.0
Retired	43	8.6	4	2.7
Use Commercial Applicator	33	6.6	1	.7
Don't use pesticides	61	12.2	2	1.3
No response	213	42.6	71	47.3
Total	500	100.0	150	100.0

The response rate of this survey is similar to that reported by Henry (1980) for a sample of licensed Michigan pesticide applicators. Five hundred questionnaires (41.7%) were returned from the original mailing of twelve hundred.

Data Coding

Graduate and undergraduate students from Michigan State University coded the completed questionnaires during the spring of 1984. The coding procedures were developed for use by all five states who participated in the survey. Every tenth questionnaire was check coded for inconsistencies. Discrepancies were discussed and coding rules established as necessary. Coded responses were than keypunched to computer cards and placed on computer tape.

Questions were coded to reflect natural order; eg., the higher the number, the greater the feeling of exposure, risk, or danger.

Description of the Variables

Some of the variables used in this study were created from answers to questionnaire items.

Health Cues to Action was created by taking the average of the weighted response to eighteen illness symptoms listed in Q-23. The scale ranges from 1 to 5. A 5 indicates that the respondent always experiences all the symptoms after working with pesticides.

A toxicity rating was assigned to each pesticide checked as being used in the past two years. Each pesticide checked was coded into four categories. The code assigned was derived from the signal words that appear on the label of the particular pesticide. Danger-Poison (category I) appears on the labels of the most toxic pesticides (code 4), Warning (category II) denotes less danger (code 3), and the signal word Caution describes pesticides that are in categories III and IV (code 2 & 1).

Demographic data was condensed into fewer groups. Respondents were grouped into six categories based on their age (Table 2, p. 47), six groups based on highest level of education reported (Table 3, p. 48), and ten income categories (Table 4,p. 49). For the purposes of statistical analysis the respondents' actual age, the real number of years of education completed, and the mid-point of the income categories was used.

Action 1, wear pesticide soiled clothing again before laundering, was created from the responses to Q-13. The index ranged from 0 days (do not wear again before laundering) to 10 (actual number of days indicated by respondent that clothing is worn before laundering).

Action 2, storage of pesticide soiled clothing separate from family laundry, was created from the tally of the number of types of soiled garments stored separate from the general family laundry as reported in Q-16. Table 11 (p.56) reports the types of garments corn and apple growers store separately.

Action 3, the protective clothing index, was created from responses to Q-11. The garments reported worn for pesticide application were assigned a value to reflect area and thickness (Appendix D). The values were summed and indicate the protection offered by the clothing. The higher the sum, the more protection during pesticide application.

Action 4, time before changing after spilling full strength liquid concentrate, is the actual time reported by respondents in Q-14 and Q-14a. Four categories were created that summarized the hours reported by the respondents. The categories ranged from less than

1 hour to 7+ hours.

Action 5, time before changing after saturation with pesticide spray, is the time reported by the respondents in Q-15 and Q-15a. Four categories were created that ranged from less than 1 hour to 7+ hours.

The dimensions of the Protective Health Actions Model were initially developed by grouping questionnaire items together based on the definitions of the HBM dimensions reviewed in the literature and an analysis of question content. The groupings were general health motivations; perception of risk, comprised of susceptibility, seriousness, and objective experience; perceived benefits vs barriers; modifying and enabling factors; and protective health behavior. These items are found in the operational definitions, p. 32 - 35.

After the initial grouping, statistical tests for reliability were run on each group to determine whether the items could be summed and used as scales. In general, the concept of reliability refers to how accurate, on the average, the estimate of the true score is in a population of objects to be measured. If all the variation in observed scores is due to errors in measurement, the reliability coefficient will be zero. If there is no error of measurement, the reliability coefficient will be one (Nie and Hull, 1981). According to Nie "alpha is perhaps the most widely used reliability coefficient." Cronbach's alpha is a reliability coefficient computed by SPSS.

Reliability coefficients of a well-made standardized test tend to be high, .9 or above. However, coefficients of .50 or less are not uncommon and may be useful (Ferguson, 1971). After reviewing the results of the computer analysis the decision was made not to use any of the groupings as they had been proposed. In every case the alpha levels were less than .50. The model constructs will therefore be represented by the individual items rather than the groupings of items.

Data Analysis Procedures

The Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, and Bent 1975, 1981) was used for all statistical programs. The level of significance for rejecting the null hypothesis was set at .05. The decision was made to look at corn and apple growers as two separate groups based on the number of hypotheses where significant differences were found to exist between the two groups. The unit of analysis is the individual corn or apple grower.

Statistical Tests

T-tests were used to test the hypotheses dealing with the differences between corn and apple growers. This analysis is the comparison of two groups, with the group mean as the basis for comparison. The goal of this analysis is to establish whether or not a difference between two samples is significant. The assumptions for this test are: normality, equality of variance, and independence. If populations of unequal variances are given, t cannot be computed. Instead, an approximation to t may be computed. An F test of sample variances is performed and a decision to base t on pooled-variance or separate variance must be made (Nie et al., 1981). SPSS allows these tests to be done simultaneously.

Pearson product-moment correlation provides a single number which summarizes the relationship between two variables. Pearson's r serves a dual purpose. It indicates the goodness of fit of the linear regression and the strength of the linear relationship between the two variables. The coefficient r takes on a value from +1.0 to -1.0. Correlations that approach +1 indicate a strong positive relationship; correlations that approach -1 indicate a strong negative relationship. When the linear regression line is a poor fit, r will be close to 0.

When Pearson's r is squared the resulting statistic, r^2, measures the proportion of variance in one variable explained by the other. It ranges from a minimum of 0 to a maximum of 1.0. The objective of correlation analysis is to determine the extent to which variation in one variable is linked to variation in the other (Nie et al., 1975).

A principal components factor analysis with iteractions and varimax rotation was conducted to locate and define dimensions among the variables. The most distinctive characteristic of factor analysis is its data reduction capability. A smaller number of clusters of variables can be obtained from a larger set of independent items. Eigenvalues, loadings and communality are important in understanding factor analysis. The eigenvalue is a measure of the relative importance of the function. The sum of the eigenvalues is a measure of the total variance existing in the discriminating variables. Total variance accounted for by the combination of all common factors is usually referred to as the communality of the variable. The loadings represent regression coefficients of factors to describe a given variable. In the initial factor analysis twelve factors were generated. A second run produced eight factors and a third, six factors. The choice of variables which were used in the second and third factor analyses was based on the eigenvalues and loading score. Variables loading at .40 were inputed for the second and third analysis. The six factors that are reported in this study are made up of variables that load at .50 or higher in the third analysis.

CHAPTER IV

ANALYSIS, FINDINGS AND DISCUSSION

This chapter presents general descriptive data about the survey sample and reports the results for the research questions and hypotheses associated with objectives one, two, and three. Findings related to the three research objectives are discussed at the end of each objective.

Description of the Sample

The data for this investigation is based on responses from seventy-two Michigan apple growers and a hundred and fifty Michigan corn growers who applied pesticides to their crops during 1982 and 1983. Three of the pesticide applicators were female.

Age

The corn applicators ranged in age from twenty to seventy-five years, with a mean of forty-seven years. Apple growers ranged in age from twenty-five to eighty, with a mean of fifty-one years (Table 2).

Education

As indicated in Table 3, the mean level of educational attainment for both corn and apple growers was twelve or more years of school.

Table 2.--Age Distribution of the Sample

Age in Years	Growers: Corn n	Corn %	Apple n	Apple %
20-30	19	12.7	4	5.6
31-40	28	18.7	12	16.7
41-50	31	20.7	20	27.8
51-60	31	20.7	14	19.4
61-70	19	12.6	10	13.9
71-80	5	3.3	6	8.3
Missing Data	17	11.3	6	8.3
Total	150	100.0	72	100.0

Mean	Corn	Apple
Ages	47 yrs.	51 yrs.

Table 3.--Education Distribution of the Sample

Education Attained	Growers Corn n	Growers Corn %	Growers Apple n	Growers Apple %
Thru 8 grades	8	5.3	6	8.3
1-3 yrs. high school	14	9.3	8	11.1
High School graduate	70	46.8	15	20.9
H.S. + 3 yrs.	33	22.0	23	31.9
Completed College	17	11.3	11	15.3
Post Graduate	3	2.0	6	8.3
Missing Data	5	3.3	3	4.2
Total	150	100.0	72	100.0

Mean	Corn	Apple
Grades Completed	12.6	13.2

Fifteen percent of the apple growers have completed college as compared to eleven percent of the corn growers. Eight percent of the apple growers have post graduate education.

Income

Family income ranged from less than $7500 per year to more than $85,000 per year for both corn and apple growers (Table 4). The mean income for corn growers is $32,738 and for apple growers is $31,336.

Table 4.--Family Income Distribution of the Sample

Category in Dollars for 1983	Growers			
	Corn		Apple	
	n	%	n	%
less $7500	20	13.3	8	11.1
7,501-17,500	37	24.7	9	12.5
17,501-25,000	26	17.3	20	27.8
25,001-35,000	18	12.0	8	11.1
35,001-45,000	8	5.3	4	5.6
45,001-55,000	6	4.0	2	2.8
55,001-65,000	5	3.4	2	2.8
65,001-75,000	1	.7	1	1.4
75,001-85,000	1	.7	0	0
85,001 plus	14	9.3	4	5.6
Missing data	14	9.3	14	19.3
Total	150	100.0	72	100.0

Descriptive Data for Objective 1

The first objective of this study was to gather base line information about applicators' selection, storage, and wearing practices for pesticide soiled clothing.

Question 1. What kind of clothing do pesticide applicators wear when applying pesticides?

Respondents were asked to check all garments that they usually wear when applying pesticides. Six groups of clothing were listed.

The first type of garment was shirts. Pesticide applicators were asked to indicate what kind of shirt they usually wear when applying pesticides. Table 5 reports shirts worn for pesticide application.

Table 5.--Shirts Worn for Pesticide Application

Style of Shirt	Growers			
	Corn		Apple	
	n	%	n	%
Long sleeved	93	62.0	58	80.6
Short sleeved	37	24.7	13	18.1
Sleeveless	5	3.3	3	6.9
No shirt	1	.7	1	1.4
Missing Data	14	9.3	0	0
Total	150	100.0	77	107.0*

*Some individuals checked more than one garment.

Long sleeved shirts were reported to be worn by sixty-two percent of the corn growers and eighty-one percent of the apple growers. Less than one and a half percent of either corn or apple pesticide applicators work without wearing a shirt.

Table 6 reports the type of pants that applicators usually wear. Approximately sixty-five percent of the corn growers and sixty-four percent of the apple growers wear jeans or work pants. A small percentage, less than three percent, wear shorts or cutoffs. No one checked wearing sweatpants.

Table 6.--Pants Worn by Pesticide Applicators

Style of Pants	Growers			
	Corn		Apple	
	n	%	n	%
Coveralls with long sleeves	32	21.3	25	34.7
Bib overalls	19	12.7	6	8.3
Jeans or Work Pants	97	64.7	46	63.9
Shorts, cutoffs	2	1.3	2	2.8
Total	150	100.0	79	109.7*

*Some individuals checked more than one garment.

As Table 7 shows, the biggest majority of applicators, both corn and apple, wear leather shoes or boots. Several respondents checked wearing waterproof vinyl or rubber boots with their leather shoes.

Table 7.--Shoes Worn for Pesticide Application

Style of shoes	Grower			
	Corn		Apple	
	n	%	n	%
Waterproof vinyl or leather	11	7.3	15	20.8
Leather	118	78.7	59	81.9
Canvas	3	2.0	1	1.4
Missing Data	18	12.0	0	0
Total	150	100.0	75	104.1*

*Some individuals checked more than one type of shoe.

Waterproof vinyl or rubber gloves are worn by thirty-nine percent of the corn growers and forty-nine percent of the apple growers. Table 8 also shows that twenty-nine percent of the corn growers and nineteen percent of the apple growers do not usually wear gloves when applying pesticides.

The styles of hats worn by pesticide applicators are reported in Table 9. Sixty-six percent of the corn growers and sixty-one percent of the apple growers wear company or baseball hats. Eight percent of the corn growers and seven percent of the apple growers indicated they do not wear any kind of head covering when applying pesticides.

Table 8.--Gloves Worn for Pesticide Application

Type of Glove	Growers: Corn n	Corn %	Apple n	Apple %
Waterproof vinyl or rubber	48	32.0	35	48.6
Leather	15	10.0	10	13.9
Canvas	22	14.7	10	13.9
Other	7	4.7	3	4.2
Usually don't wear	43	28.7	14	19.4
Missing data	15	10.0	0	0
Total	150	100.0	72	100.0

Table 9.--Hats Worn for Pesticide Application

Style of Hat	Growers: Corn n	Corn %	Apple n	Apple %
Hard plastic	3	2.0	9	12.5
Felt	5	3.3	1	1.4
Straw	3	2.0	5	6.9
Company or baseball	99	66.0	44	61.2
Other	10	6.7	6	8.3
Usually don't wear	12	8.0	5	6.9
Missing Data	18	12.0	2	2.8
Total	150	100.0	72	100.0

Other Clothes, shown in Table 10, has nine different types of clothing listed. Twenty-seven percent of the apple growers reported wearing a waterproof jacket but only eleven percent of them wear waterproof pants. Only about six percent of the corn growers indicated they wear waterproof jackets and pants. Several respondents wrote that they ride in an enclosed tractor cab which they feel offers protection.

Table 10.--Other Clothing Worn for Pesticide Application

Type of Clothing	Growers: Corn n	Corn %	Apple n	Apple %
Jacket or coat	59	39.3	36	50.0
Sweatshirt	26	17.3	9	12.5
Sleeveless vest	10	6.7	4	5.6
Undershirt	63	42.0	31	43.1
Jockey/Boxer shorts	75	50.0	37	51.4
Socks	83	55.3	44	29.3
Belt	72	48.0	33	45.8
Waterproof jacket	9	6.0	20	27.8
Waterproof pants	10	6.7	8	11.1

The typical pesticide applicator, both corn and apple, is likely to wear a long sleeved shirt, jeans or work pants, leather shoes, waterproof vinyl or rubber gloves, and a company or baseball style hat.

Approximately one-third of the corn growers wear a jacket or coat as compared to fifty percent of the apple growers. In both groups about forty percent wear undershirts and fifty percent indicated they wear jockey or boxer shorts. Only one respondent wrote in the questionnaire that a respirator was worn.

Question 2. Where is pesticide soiled clothing stored before laundering?

Pesticide applicators were asked to check whether they stored clothing worn for pesticide application with other family laundry or separate from other family laundry. Seven categories of clothing were listed. These were:

a. shirts, jeans, workpants
b. underwear
c. jackets, coveralls
d. boots, shoes
e. hats, caps
f. gloves
g. belts

In six out of the seven categories of clothing, over fifty percent of both corn and apple growers stored the types of laundry separate from the other family laundry. Category b, underwear, was the only type of clothing that was stored over fifty percent of the time with other family laundry. Table 11 reports the storage of pesticide soiled clothing together or separate from the rest of the family laundry.

Table 11.--Storage of Pesticide Soiled Clothing Before Laundry

	Growers							
	Corn				Apple			
Type of Clothing	With Family		Separate		With Family		Separate	
	n	%	n	%	n	%	n	%
Shirts, jeans, workpants	42	28.0	100	66.7	16	22.2	54	75.0
Underwear	78	52.0	57	38.0	39	54.2	22	30.6
Jackets, coveralls	26	17.3	102	68.0	9	12.5	57	79.2
Boots, shoes	29	19.3	103	68.7	13	18.1	55	76.4
Hats, caps	30	20.0	96	64.0	10	13.9	57	79.2
Gloves	20	13.3	101	67.3	6	8.3	57	79.2
Belts	38	25.3	78	52.0	20	27.8	40	55.6

Corn n = 150

Apple n = 72

Question 3. What kind of actions do corn and apple growers engage in when clothing becomes soiled with pesticides?

Table 12 reports the number of applicators who wear clothes soiled with pesticides again before they are laundered. Seventy-one percent of corn applicators and seventy-two percent of apple applicators do not wear pesticide soiled clothing again before laundering. However, twenty-five percent of the apple growers do wear their soiled clothing again.

Table 12.--Wear Soiled Clothing Again Before Laundering

Soiled garments worn again	Growers: Corn n	Corn %	Apple n	Apple %
No	106	70.7	52	72.2
Yes	22	14.6	18	25.0
Missing data	22	14.7	2	2.8
Total	150	100.0	72	100.0

When asked how many days the pesticide soiled clothing was worn applicators reported wearing the clothing from one to ten days before laundering. Table 13 reports the number of days soiled clothing is worn before laundering. Approximately five percent of the corn growers and ten percent of the apple growers wear pesticide soiled clothing for two days before laundering.

Table 13.--Number of Days Soiled Clothing Worn Before Laundering

Number of Days	Growers: Corn n	Corn %	Apple n	Apple %
0	106	70.7	52	72.2
1	0	0	3	4.2
2	7	4.7	7	9.6
3	7	4.7	2	2.8
4	1	.7	1	1.4
5	2	1.2	3	4.2
7	1	1.4	0	0
10	0	0	1	1.4
Missing data	27	18.0	2	2.8
Total	150	100.0	72	100.0

Table 14 shows responses to the question of how soon corn and apple growers reported changing clothing if full strength concentrate was spilled on non-waterproof clothing. Twenty-one percent of the corn growers and thirteen percent of the apple growers indicated they did not spill liquid concentrate on themselves. Forty-one percent of the corn growers and twenty-six percent of the apple growers reported changing within an hour of the spill. Thirteen percent of the corn growers wore clothing that had been soiled with liquid concentrate for seven or more hours as compared to only one percent of the apple growers.

Table 14.--Time Reported Before Changing Non-waterproof Clothing After Spilling Full Strength Liquid Concentrate

Time Reported Before Changing Clothes	Growers: Corn n	Corn %	Apple n	Apple %
Don't spill	21	14.0	13	18.1
Less than 1 hour	41	27.3	26	36.1
1 - 3 hours	28	18.7	20	27.8
4 - 6 hours	12	8.0	5	6.9
7 or more hours	19	12.7	1	1.4
Missing data	29	19.3	7	9.7
Total	150	100.0	72	100.0

$\overline{X}$ corn = 1.3 hours $\overline{X}$ apple = .9 hours

When asked how soon they changed after their non-waterproof clothing became saturated with pesticide spray, thirty percent of the corn applicators and thirty-six percent of the apple growers reported changing in less than an hour. Table 15 reports that approximately six percent of both corn and apple growers wear clothing that has become saturated with pesticide spray for seven or more hours. Seventeen percent of the corn growers and twenty-one percent of the apple growers responded that they did not become saturated with spray. As Tables 14 and 15 show, approximately twenty percent of the corn growers did not respond to either question. It is possible they use only a granular formulation.

Table 15.--Time Reported Before Changing Non-waterproof Clothing That Has Become Saturated with Pesticide Spray

	Growers			
Time Reported Before Changing Clothes	Corn n	Corn %	Apple n	Apple %
Not Saturated	26	17.3	15	20.9
Less than 1 hour	45	30.0	26	36.1
1 - 3 hours	31	20.7	18	25.0
4 - 6 hours	9	6.0	3	4.2
7 or more hours	9	6.0	5	6.9
Missing data	30	20.0	5	6.9
Total	150	100.0	72	100.0
	$\overline{X}$ corn = 2.4 hours		$\overline{X}$ apple = 2.4 hours	

When reporting actions in regard to clothing that becomes soiled with pesticides approximately seventy percent of both corn and apple growers do not wear their pesticide soiled garments again before laundering. However, twenty-five percent of the apple growers reported wearing their soiled clothing again. One respondent reported wearing his soiled clothing for ten days.

When asked how soon they changed after spilling either full strength liquid concentrate on their clothes or becoming saturated with spray both corn and apple growers reported similar actions. Less than twenty percent reported they don't spill.

Tests and Findings for Objective 2

Procedures and test statistics for hypotheses were presented in Chapter III. The results of statistical tests performed for each hypotheses are presented and the hypotheses are stated in the null form.

Objective 2 is to determine if there are any differences between corn and apple growers in the study. It should be noted that the greater the number of separate tests performed, the greater the likelihood that some difference may be claimed as real when it is actually due to chance (Type II error).

H1: There will be no significant difference between the mean ages of corn and apple growers.

The two-tailed independent t-test (129) = -1.87 compared to the table value of 1.98, $p < .05$ indicates the decision is to accept the null hypotheses. There is no significant difference in the mean ages of corn and apple growers. The mean age of corn growers is 47 years and 51 years for apple growers (Table 2, p. 47).

H2: There will be no significant difference between the mean years of education of corn and apple growers.

The mean years of education for corn growers is 12.6 and 13.2 for apple growers (Table 3, p. 48). The two-tailed independent t-test (109) = -1.60 compared to the table value of 1.98, $p < .05$ indicates that the decision is to accept the null hypotheses. There is no significant difference in the mean years of education for corn and apple growers.

> H3: There will be no significant difference between the mean incomes of corn and apple growers.

The mean income for corn growers is $32,739 and $31,336 for apple growers (Table 4, p. 49). Based on results of the two-tailed t-test the decision is made to accept the null hypotheses that there are no significant differences between the mean incomes of corn and apple growers.

> H4: There will be no significant difference between the mean family size of corn and apple growers.

The mean family size for corn growers is 3.6 members and 3.3 members for apple growers. Based on the two-tailed independent t-test (211) = 1.51 compared to the table value of 1.97, $p < .05$ the decision is to accept the null hypothesis that there are no significant differences between the mean family size of corn and apple growers.

> H5: There will be no significant difference between the mean ages of the youngest child living at home under 18 years for corn and apple growers.

The average age of the youngest child living at home for corn growers is 8.2 years and 9.5 years for apple growers. Based on the two-tailed independent t-test the decision is made to accept the hypothesis that there is no significant difference between the mean ages of the youngest child living at home for corn and apple growers.

> H6: There will be no significant difference between the mean number of years individual corn and apple growers have been applying pesticides.

Table 16 reports the number of years that corn and apple growers have been applying pesticides.

Table 16.--Years Applying Pesticides

Number of Years	Growers: Corn n	Corn %	Apple n	Apple %
2 - 10	56	37.3	15	20.8
11 - 20	59	39.3	19	26.4
21 - 30	20	13.3	15	20.8
31 - 40	7	4.7	12	16.7
41 - 50	1	.7	1	1.4
51 - 60	1	.7	1	1.4
61 - 65	0	0	1	1.4
Missing data	6	4.0	1	1.4
Total	150	100.0	72	100.0

$\overline{X}$ corn = 16.1 $\overline{X}$ apple = 24.7

Corn growers have been applying pesticides for an average of 16.1 years and apple growers for an average of 24.7 years. The decision is made is reject the null hypothesis based on the two-tailed independent t-test. There is significant difference in the mean number of years that corn and apple growers have been applying pesticides. Apple growers have applied pesticides for more years on the average.

> H7: There will be no significant difference between the mean number of days per year that individual corn and apple growers apply pesticides.

Corn growers apply pesticides a mean of 17.8 days per year while apple growers apply pesticides a mean of 36.8 days per year. Based on the two-tailed independent t-test the decision is made to reject the null hypothesis. There is a significant difference between the number of days that corn and apple growers apply pesticides each year. Table 17 shows that apple growers use pesticides more days per year than do corn growers.

Table 17.--Days per Year Applying Pesticides

Days Per Year	Growers: Corn		Growers: Apple	
	n	%	n	%
1 to 30 days	133	88.7	41	56.9
31 to 90 days	6	4.0	25	34.8
91 to 180 days	5	3.3	5	6.9
Missing data	6	4.0	1	1.4
Total	150	100.0	72	100.0

$\overline{X}$ corn = 17.8 $\overline{X}$ apple = 36.8

H8: There will be no significant difference between the toxicity of pesticides used by corn and apple growers.

Tables 18 and 19 report the toxicity of insecticides and other pesticides used in the past two years.

Table 18.--Insecticide Used Most in Past Two Years.

Toxicity of Insecticide	Growers: Corn n	Corn %	Apple n	Apple %
1 = least toxic	0		0	
2 = less toxic	31	20.7	5	6.9
3 = toxic	42	28.0	15	20.8
4 = most toxic	35	23.3	48	66.7
Missing data	42	28.0	4	5.6
Total	150	100.0	72	100.0

$\bar{X}$ corn = 3.0 $\bar{X}$ apple = 3.6

Table 19.--Other Pesticides Used Most in Past Two Years

Toxicity of Other Pesticides	Growers: Corn n	Corn %	Apple n	Apple %
1 = least toxic	1	.7	0	0
2 = less toxic	53	35.3	16	22.2
3 = more toxic	23	15.3	6	8.3
4 = most toxic	33	22.0	43	59.8
Missing data	40	26.7	7	9.7
Total	150	100.0	72	100.0

$\bar{X}$ corn = 2.8 $\bar{X}$ apple = 3.4

The decision is to reject the null hypothesis based on the two-tailed independent t-test for both groups of chemicals. There is significant differences in the toxicity of the pesticides used by corn and apple growers. Apple growers use more toxic chemicals.

H9: There will be no significant difference between corn and apple growers regarding the kind of clothing that is worn to apply pesticides.

Based upon the score that each applicator received through the use of the protective clothing index (Appendix D), the two-tailed independent t-test indicated that the decision is to reject the null hypothesis. There is a difference in the kind of clothing that corn and apple growers wear to apply pesticides. The clothing index score reflects the area and thickness of the clothing that applicators indicated they wear when applying pesticides. The higher the score the more protection offered. The possible range for scores is four to forty-four. The mean of the clothing index scores for corn growers is 19.9 and 22.0 for apple growers. Apple growers reported wearing clothing that affords more protection.

H10: There will be no significant difference between the storage practices for pesticide soiled clothing of corn and apple growers.

Table 20 shows the number of pesticide soiled garments that are stored with the family laundry. Corn growers store a mean of 2.8 soiled garments with other family laundry and apple growers a mean of 2.6 garments. The two-tailed independent t-test indicates that there is no significant difference between the storage practices of corn and apple growers, therefore the null hypothesis is accepted.

Table 20.--Soiled Garments Stored With Family Laundry

Category of Storage	Growers: Corn n	Corn %	Apple n	Apple %
All stored separate	58	38.7	25	34.7
1 with family	31	20.7	20	27.8
2 with family	18	12.0	11	15.3
3 with family	16	10.7	7	9.7
4 with family	8	5.3	2	2.8
5 with family	6	4.0	2	2.8
6 with family	5	3.3	3	4.1
All with family	8	5.3	2	2.8
Missing data	0	0	0	0
Total	150	100.0	72	100.0

$\bar{X}$ corn = 2.8 $\bar{X}$ apple = 2.6

H11: There will be no significant difference in the toxicity of the pesticide that is spilled on clothing worn by corn and apple growers.

Table 21 shows the toxicity of the pesticides applicators report most frequently gets on their clothing. The mean of the toxicity of the chemicals that get on corn growers clothing most often is 1.9 and the mean for apple growers is 3.2. The decision based on the two-tailed independent t-test is to reject the null hypothesis. The toxicity of the spills that get on applicators clothing is significantly different for corn and apple growers. Apple growers reported getting more toxic pesticides on their clothing than did corn growers.

Table 21.--Toxicity of Pesticides Spilled on Clothing

Toxicity of Pesticide	Growers: Corn n	Corn %	Apple n	Apple %
Never spill	42	28.0	7	9.7
1 = least toxic	0	0	0	0
2 = less toxic	29	19.4	9	12.5
3 = more toxic	23	15.3	14	19.5
4 = most toxic	32	21.3	41	56.9
Missing data	32	21.3	1	1.4
Total	150	100.0	72	100.0

$\overline{X}$ corn = 1.9 $\overline{X}$ apple = 3.2

H12: There will be no significant difference in the time reported by corn and apple growers to change non-waterproof clothing after spilling full strength liquid concentrate on themselves.

Table 14 (p. 59) reports the time that corn and apple growers reported it took them to change after a full strength liquid concentrate spill. The two-tailed independent t-test (184) = 2.30 compared to the table value of 1.97, $p < .05$ indicates the decision to reject the null hypothesis. There is significant difference in the time reported by corn and apple growers to change their clothing after spilling full strength liquid concentrate. Corn growers report wearing their soiled clothing longer on the average than do apple growers.

H13: There will be no significant difference in the time reported by corn and apple growers to change clothing that has been saturated with pesticide spray.

Results of the two-tailed independent t-test indicate the decision to accept the null hypothesis. There is no significant difference in the time reported by corn and apple growers to change clothing that has been saturated with pesticide spray. Table 15 (p. 60) reports the time estimated to change spray saturated clothing. The mean time for both corn and apple growers is 2.4 hours.

Summary of Findings for Objective 2

There are no significant differences between corn and apple growers in regard to age, years of education, income, family size, ages of children under eighteen living at home, laundry storage of pesticide soiled clothing, and the length of time non-waterproof clothing saturated with spray is reported worn.

There are significant differences in number of years that the corn and apple growers have applied pesticides, the days per year that corn and apple growers apply pesticides, the toxicity of pesticides used in the last two years by corn and apple growers, the kind of clothing that is worn, the length of time that non-waterproof clothing soiled with full strength liquid concentrate is worn and the toxicity of the pesticides that are reported to get on applicators' clothing.

Questions and Hypotheses for Objective 3

Objective 3 is to explore a model which explains actions taken with respect to pesticide soiled clothing.

> Question 1. Do components of the Protective Health Action Model (Fig. 3, p. 30) help predict the likelihood of protective clothing actions for pesticide applicators?
>
> H1: Among pesticide applicators the variables that comprise general health behavior will not be significantly related to protective health actions.

Six questions were originally included in the General Health Dimension (p. 32). Only variables which correlated at $p < .05$ are reported.

As indicated in Table 22 four of the five Protective Health Actions (p. 33) showed significant correlations with four statements from the General Health Dimension.

Table 22.--Pearson Product Moment Correlations Between General Health and Protective Health Actions

General Health	Action 1	Action 2		Action 3		Action 5	
	Grower	Growers		Growers		Growers	
	Corn	Corn	Apple	Corn	Apple	Corn	Apple
Can't avoid pesticides on clothes	.179 .027					.173 .030	.243 .025
Risk just part of job	-.169 .033				.238 .026		-.290 .010
Don't go in house wearing soiled clothes		-.200 .008	-.353 .001	.196 .015			
Pesticides differ in toxicity					-.238 .020		

Action 1 = Wear pesticide soiled clothing again before laundering.

Action 2 = Storage of pesticide soiled clothing separate from family laundry.

Action 3 = Protective clothing index.

Action 5 = Time before changing after saturation with pesticide spray.

For corn growers there was a positive, weak relationship between the statement that one can't avoid getting pesticide on clothing ($r = .179$, $p = .027$) and Action 1, wear soiled clothing again before laundering. A significant, negative relationship was found between the statement that risk is just part of the job ($r = -.169$; $p = .033$) and Action 1. Corn growers who believe that one can't avoid getting pesticides on clothing and that risks are just part of the job in applying pesticides reported wearing soiled clothing longer than other corn growers.

For both corn ($r = -.200$; $p = .008$) and apple ($r = -.353$; $p = .001$) growers there was a negative, moderate relationship between the belief that one should not go into the house wearing pesticide soiled clothing and Action 2, store soiled clothing separate from family laundry. Agreeing that one should not go into the house wearing pesticide soiled clothing was associated with a greater number of garment types stored separate from the family laundry.

There were significant relationships between three General Health Dimension statements and Action 3, the clothing index. For corn growers a weak relationship exists between the statement don't go into the house wearing pesticide soiled clothing ($r = .196$; $p = .015$) and the clothing index. Apple growers showed a positive relationship between risk is just part of the job ($r = .238$; $p = .026$) and Action 3 and a negative relationship between the statement that pesticides differ in toxicity ($r = -.238$; $p = .020$) and Action 3. Corn growers who believed that one shouldn't go into the house wearing pesticide soiled clothing were more likely to score higher on the clothing index, eg, have more body covering when applying pesticides. Agreement about variation in toxicity and disagreement with risk as part of the job was associated with wearing more clothing for apple growers.

For corn ($r = .173$; $p = .030$) and apple ($r = .243$; $p = .025$) growers there was a significant, positive relationship between the statement that one can not avoid pesticides on clothes and Action 5. Apple growers had a moderate, negative relationship ($r = -.290$; $p = .010$) with the belief that risks are just part of the job and Action 5. The more likely both corn and apple growers were to agree that people can't avoid getting pesticide on their clothing, the longer they reported taking to change their clothing after becoming saturated with pesticide spray. Apple growers who agree that risks are just part of the job in pesticide application also reported taking longer to change after becoming saturated with spray.

Two kinds of relationships are observed between reported behaviors and actions in the General Health Dimension. There seems to be an attitude about risk which can be characterized in terms of a risk taker or a risk avoider.

The attitudes associated with a risk taker are reflected in findings of Action 1. Corn growers who believe that one can't avoid getting pesticides on clothing and that risks are just part of the job reported wearing soiled clothing longer. They indicate a feeling of "it isn't going to affect me anyway so why bother with wearing clean clothing every day." They also indicated they did not immediately change clothing that was saturated with spray.

The risk avoider reports correlations of high scores on the clothing index and storing garments separate from the family laundry and the belief that one should not go into the house wearing pesticide soiled clothing. The applicators labeled as risk avoiders also disagreed that risk is just part of the job.

H2: Among pesticide applicators the variables that comprise perception of risk will not be significantly related to protective health actions.

Perception of risk is comprised of three dimensions: A) Susceptibility, B) Seriousness, and C) Objective Experience.

Susceptibility

The initial susceptibility scale was comprised of seven questions (p. 31). The statements which showed significant correlations at the .05 level with at least one of the five protective health actions are reported in Table 23.

Corn growers showed a significant, negative relationship between the belief that getting pesticides on the skin will cause long-term harm ($r = -.270$; $p = .002$) and Action 1. Corn growers who disagreed that pesticide on the skin will cause long term harm indicated they wore their pesticide soiled clothing again before laundering. Evidently they did not view the pesticide soiled clothing as a health hazard.

Corn growers showed a positive, moderate relationship between the belief that clothing is effective in offering protection from pesticide exposure ($r = .269$; $p = .013$) and Action 2. Apple growers reported a positive relationship between the statement that clothes keep pesticide off the skin ($r = .180$; $p = .016$) and Action 2. Apple growers who agree that the clothing they usually wear is effective in protecting them and corn growers who agree that clothes keep pesticide off the skin reported storing garments separate from the family laundry.

Table 23.--Pearson Product Moment Correlations Between Susceptibility and Protective Health Actions

	Action 1	Action 2		Action 3		Action 4		Action 5	
	Grower	Growers		Growers		Growers		Growers	
	Corn	Corn	Apple	Corn	Apple	Corn	Apple	Corn	Apple
Clothes offer protection			.269 .013						
Clothes keep pesticide off the skin		.180 .016			-.302 .006	.174 .030		.198 .016	
Likelihood of long-term harm	-.270 .002			.167 .035					
Frequency that pesticide gets on clothes				.204 .010					.229 .031
Frequency pesticide gets through to skin					-.249 .021				.268 .016
Likelihood immediate health risk				.301 .001	.296 .008				
People tough enough to take pesticides				.323 .001			-.227 .036		-.264 .017

Action 1 = Wear pesticide soiled clothing again before laundering.

Action 2 = Storage of pesticide soiled clothing separate from family laundry.

Action 3 = Protective clothing index.

Action 4 = Time before changing after spilling full strength liquid concentrate.

Action 5 = Time before changing after saturation with pesticide spray.

As shown in Table 23, for corn growers there is a significant and positive relationship between the likelihood of long-term harm ($r = .167$; $p = .035$), the frequency that pesticide gets on clothes ($r = .204$; $p = .010$), the likelihood of immediate health risk ($r = .301$; $p = .001$), the belief that most people are not tough enough to take pesticide exposure ($r = .323$; $p = .001$) and Action 3. Corn growers who agreed that there is a likelihood of immediate health risk and long-term harm, reported getting pesticides on their clothing, and believed that most people are not tough enough to take pesticide exposure scored high on the clothing index, eg. covered the body more.

Apple growers reported two negative and one positive relationship with Action 3. These are the belief that clothes keep pesticides off the skin ($r = -.302$; $p = .006$), the frequency with which pesticides get through to the skin ($r = -.249$; $p = .021$) and the likelihood of immediate health risk ($r = .296$; $p = .008$). Apple growers who agreed that clothes keep pesticides off the skin, that pesticides do not get through clothing to the skin, and believe that it is very likely there might be an immediate health risk scored high on the clothing index.

For corn growers there is a slight, significant relationship between the statement clothes keep pesticide off the skin ($r = .174$; $p = .030$) and Action 4. Apple growers show a negative relationship between the statement that people are tough enough to take pesticide exposure ($r = -.227$; $p = .036$) and Action 4. Corn growers who disagreed that clothes keep pesticide off the skin and apple growers who agreed that most people are tough enough to take pesticide exposure reported taking longer to change their clothing after spilling full strength liquid concentrate on themselves. The relationship for corn growers is difficult to explain. Perhaps corn growers do not identify with the use of liquid concentrate or they believe that the skin is a barrier to absorption. Apple growers do not reveal a high degree of susceptibility. They express the belief that people are tough enough to take pesticide exposure and report not changing immediately after spilling full strength liquid concentrate on their clothing.

For corn growers, the statement that clothes keep pesticide off the skin ($r = .198$; $p = .016$) showed a positive relationship with Action 5. For apple growers, the frequency that pesticide gets on clothes ($r = .229$; $p = .031$), frequency that pesticides gets through to the skin ($r = .268$; $p = .016$), and the statement that people are tough enough to take pesticide exposure ($r = -.264$; $p = .017$) were significantly related to Action 5. The more likely corn growers were to disagree that clothes keep pesticides off the skin, the longer it takes them to change their clothing after becoming saturated with pesticide spray. This may again be a situation where corn growers do not identify with the use of spray. Or, they may believe that if the clothing is wet and they are not changing quickly, pesticide is getting on the skin anyway. Apple growers were likely to agree that pesticide often gets on their clothes and through the clothing to the skin. This is very reasonable if in fact they are wearing clothing that has been saturated with spray for long periods of time. Apple growers also indicated that the insecticide and other pesticide that most frequently gets on their clothes is toxic. Many of the sprays used by apple growers are insecticides which are highly toxic. This may reflect a statement of knowledge about the chemicals they are using. However, it also indicates lack of belief in susceptibility and a risk taker's attitude. They know the chemical on their clothing is toxic but are not bothering to change quickly after being saturated with spray.

Seriousness

Table 24 shows that for corn growers there was a statistically, significant relationship between the belief that getting pesticides on the skin will cause serious long-term harm ($r = -.175$; $p = .046$) and Action 1. Corn growers who believed that long-term harm was not very serious were more likely to wear their pesticide soiled clothing again before laundering. There were no other actions related to the seriousness dimension.

Table 24.--Pearson Product Moment Correlations Between Seriousness and Protective Health Action 1

	Action 1 Wear Pesticide Soiled Clothing Again Before Laundering
	Growers
	Corn
Seriousness of	-.175
long-term harm	.046

Objective Experience

Five objective measures were included in the objective experience dimension of perception of risk. The correlations for four of these measures are reported on Table 25, page 81.

For corn growers the days per year they apply pesticides ($r = .169$; $p = .032$) and the toxicity of other pesticides that most frequently get on their clothes ($r = .197$; $p = .028$) is significantly related to Action 1. The longer corn growers apply pesticides during the year the more likely that they will wear their soiled clothing again before laundering.

As the old saying goes, "Familiarity breeds contempt." As corn growers work with toxic pesticides, it may be that as they handle them

Table 25.--Pearson Product Moment Correlations Between Objective Experience and Protective Health Actions.

	Action 1	Action 2	Action 4	Action 5
	Grower	Grower	Grower	Grower
	Corn	Apple	Apple	Apple
Days/year applying pesticides	.169 .032		.241 .028	
Toxicity of insecticide used most last 2 yrs.			.245 .027	
Toxicity of insecticide most frequently gets on clothing				.222 .036
Toxicity of other pesticides most frequently gets on clothing	.197 .028	.220 .043		.337 .002

Action 1 = Wear pesticide soiled clothing again before laundering.

Action 2 = Storge of pesticide soiled clothing separate from family laundry.

Action 4 = Time before changing after spilling full strength liquid concentrate.

Action 5 = Time before changing after saturation with pesticide spray.

for long periods of time they lose sight of the need for protective health actions. This may be part of a risk taker's attitude.

The relationship of the toxicity of other pesticides most frequently getting on the clothing was significantly related to Action 2 for apple growers ($r = .220$; $p = .043$). The more toxic the chemical used the less likely that pesticide soiled garments would be stored separate from the family laundry. This relationship does not seem reasonable but it is possible. If the applicator does not perceive a risk despite the toxicity of the pesticide which is on the clothing it is likely that little effort would be made to store the soiled clothing separate from the family's laundry.

The days per year applying pesticides ($r = .241$; $p = .028$) and the toxicity of the insecticide used most in the last two years ($r = .245$; $p = .027$) showed a moderate, positive relationship with Action 4 for apple growers. Applicators who used pesticides more days per year than others and indicate that they have used highly toxic insecticides in the past two years took longer to change their clothing after spilling full strength liquid concentrate. These actions may be typical of a risk taker. Applicators who use pesticides for long lengths of time may not view them as dangerous.

For apple growers a significant relationship was shown to exist between the toxicity of the insecticide that most frequently gets on clothes ($r = .222$; $p = .036$) the toxicity of other pesticides that most frequently get on clothes and Action 5. Apple growers who take longer to change their clothing after becoming saturated with pesticide spray also indicate that the insecticide and other pesticides that most frequently get on their clothing is toxic. Again this is a situation where there seems to be little perception of risk. Apple growers indicate that they are using toxic sprays yet do not quickly change their clothing after becoming saturated with spray. They do not feel susceptible to the effects of pesticide spray.

> H3: Among pesticide applicators the variables that comprise perceived benefits will not be significantly related to protective health actions.

Perceived benefits of pesticide use are defined as the responses to questions 26 and 35 (p. 32). Table 26 shows that for corn growers there was a slight significant relationship between the statement that the benefits of pesticides exceed the risks ($r = .180$; $p = .026$) and Action 5. Corn growers who agreed that the benefits of pesticides far exceed whatever risk there is, reported taking longer to change their clothing after becoming saturated with pesticide spray. A strong belief in the benefits of pesticide use may actually be a barrier to protective action.

Table 26.--Pearson Product Moment Correlations Between Perceived Benefits and Protective Health Action.

	Action 5 Time Reported to Change Clothing That Has Become Saturated With Pesticide Spray
	Growers Corn
Benefits far exceed the risks	.180 .026

H4: Among pesticide applicators the variables that comprise perceived barriers will not be significantly related to protective health actions.

Two attitudinal statements were asked to measure the perception of perceived barriers to pesticide use (p. 34). Table 27 reports the correlations for these statements and the protective health actions.

For corn growers there is a negative relationship between the belief that there are lots of things on the farm far more dangerous than pesticides (r = -.249; p = .003) and Action 1. Corn growers who agreed that there are lots of things on the farm far more dangerous than pesticides reported wearing soiled clothing again before laundering. Risk is relative, the corn grower may be more concerned about getting caught in the power takeoff of his tractor than illness from pesticides.

This lack of perception of risk may be a barrier to any protective health action in regard to clothing. The grower may view other safety and health protective actions as much more important.

Table 27.--Pearson Product Moment Correlations Between Perceived Barriers and Protective Health Actions

	Action 1 Wear Pesticide Soiled Clothing Again Before Laundering
	Growers
	Corn
Lots of things on farm far more dangerous than pesticides	-.249 .003

H5: Among pesticide applicators modifying and enabling factors will not be significantly related to protective health actions.

Seven variables were chosen to represent possible modifying or enabling factors (p. 34). Only two variables, applicator's age and illness symptoms, were significantly related to any protective health actions.

Table 28 shows that for corn growers a positive relationship exists between illness symptoms ($r = .220$; $p = .048$) and Action 1. Illness symptoms after working with pesticides were reported by those corn growers who wear soiled clothing again before laundering. Also reported for corn growers is a relationship between illness symptoms ($r = -.176$; $p = .025$) and Action 3. Corn growers who reported fewer illness symptoms scored high on the clothing index.

For apple growers there is a negative relationship between applicator's age (r = -.348; p = .002) and Action 2. The older the apple grower the more likely that pesticide soiled garments would be stored separate from the family laundry.

There also is a significant, negative relationship for apple growers between applicator's age (r = -.275; p = .014) and Action 3. Older apple growers were more likely to score higher on the Clothing Index.

Table 28.--Pearson Product Moment Correlations Between Modifying and Enabling Factors and Protective Health Actions

	Action 1	Action 2	Action 3	
	Grower	Grower	Grower	
	Corn	Apple	Corn	Apple
Applicator's Age		-.348 .002		-.275 .014
Illness Symptoms	.220 .008		-.176 .025	

Action 1 = Wear pesticide soiled clothing again before laundering.

Action 2 = Storage of pesticide soiled clothing separate from family laundry.

Action 3 = Protective clothing index.

Summary of Hypotheses and Findings for Objective 3

1. Do components of the Protective Health Action Model help predict the likelihood of protective clothing actions for pesticide applicators?

H1: Among pesticide applicators the variables that comprise general health behavior will not be significantly related to protective health actions.

Seven questions are included in the general health dimension. Four variables showed significant correlations at the .05 level with at least one of four protective health actions and the null hypotheses is rejected for these variables. Table 29 (p. 88) indicates which variables for corn and apple growers are significantly related to protective health actions.

H2: Among pesticide applicators the variables that comprise perception of risk will not be significantly related to protective health actions.

Perception of risk is comprised of three dimensions: A) Susceptibility, B) Seriousness, and C) Objective Experience.

Table 30 (p. 89) reports the significant correlations for the perception of risk variables and protective health actions. The null hypothesis is rejected for the variables showing significant correlations at the .05 level. The susceptibility dimension is represented by eight statements. Seven of the eight variables showed significant correlations with at least one of the five protective health actions.

Table 29.--Summary of Significant Correlations for General Health and Protective Health Actions for Corn and Apple Growers

Variables that Comprise General Health Motivations	Actions 1	2	3	4	5
People really can't avoid getting pesticide on their clothes if they farm nowadays.	C*				C&A*
Insecticide should be used only when monitoring the insects indicates it is needed.					
People should never go into the house wearing clothes that have pesticide on them.		C&A*	C*		
Pesticides are not harmful if they are handled properly.					
It is better to pay someone else to apply pesticide and avoid the health risk.					
Risks are just part of the job in pesticide application.	C*		A*		A*
Pesticides differ in toxicity-some are very dangerous and others are not.			A*		

C* = Significant at .05 level of probability for corn growers. Null hypothesis rejected.

A* = Significant at .05 level of probability for apple growers. Null hypothesis rejected.

C&A* = Significant at .05 level of probability for corn and apple growers. Null hypothesis rejected.

One seriousness statement was significantly correlated with one protective health action. Four of the five variables which represent objective experience are significantly correlated with at least one action.

Table 30.--Summary of Significant Correlations for Perception of Risk and Protective Health Actions for Corn and Apple Growers

Variables that Comprise Perception of Risk	Actions 1	2	3	4	5
Susceptibility					
How often would you say pesticide gets on your clothes?			C*		A*
When pesticide gets on your clothes, how often does it get through the clothing to the skin?			A*		A*
How effective do you feel the clothes you usually wear are in protecting you from pesticide exposure?		A*			
How likely is it that getting pesticides on your skin will cause immediate health risk?			C&A*		
How likely is it that getting pesticides on your skin will cause long-term harm?	C*		C*		
Clothes keep pesticide off the skin.		C*	A*	C*	C*
Most people are tough enough to take exposure to pesticides without harm.			C*	A*	A*
The risk involved in getting pesticide on clothes is nothing compared to breathing air pollution.					

Table 30 (cont.)

Variables that Comprise Perception of Risk	Actions 1	2	3	4	5
<u>Seriousness</u>					
How serious do you think that immediate health risk is apt to be?					
How serious do you think that long-term harm is apt to be?	C*				
<u>Objective Experience</u>					
Years of pesticide use.					
Number of days per year using pesticides.	C*			A*	
Toxicity of insecticides used most in the past two years.				A*	
The toxicity of the pesticides that most often get on clothes.					A*
Toxicity of other pesticides most often get on clothing.	C*	A*			A*

C* = Significant at .05 level of probability for corn growers. Null hypothesis rejected.

A* = Significant at .05 level of probability for apple growers. Null hypothesis rejected.

C&A* = Significant at .05 level of probability for corn and apple growers. Null hypothesis rejected.

H3: Among pesticide applicators the variables that comprise perceived benefits will not be significantly related to protective health actions.

Perceived benefits of pesticide use are represented by two attitudinal statements. One statement was significantly correlated with one protective health action.

Table 31.--Summary of Significant Correlations for Perceived Benefits and Protective Health Actions for Corn and Apple Growers

Variables that comprise Perceived Benefits	Actions 1	2	3	4	5
Overall, for you personally how would you rate the crop yield benefit associated with pesticide application?					
The benefits of pesticides far exceed whatever risks may be involved.					C*

C* = Significant at .05 level of probability for corn growers.
Null hypothesis rejected.

H4: Among pesticide applicators the variables that comprise perceived barriers will not be significantly related to protective health actions.

Perceived barriers to pesticide use are measured by two statements. One statement is significantly correlated with one protective health action. Table 32 reports the variables and significant correlations.

Table 32.--Summary of Significant Correlations for Perceived Barriers and Protective Health Actions for Corn and Apple Growers

Variables that Comprise Perceived Barriers	Actions 1	2	3	4	5
Overall, for you personally, how would you rate the health risk associated with pesticide application?					
There are lots of things on the farm that are far more dangerous than pesticides.	C*				

C* = Significant at .05 level of probability for corn growers.
Null hypothesis rejected.

H5: Among pesticide applicators modifying and enabling factors will not be significantly related to protective health actions.

Seven health related variables comprise this factor. Two variables were significantly correlated with three protective health actions. Table 33 reports these variables and correlations.

Table 33.--Summary of Significant Correlations for Modifying and Enabling Factors and Protective Health Actions for Corn and Apple Growers

Modifying and Enabling Variables	Actions 1	2	3	4	5
Applicator's age		A*	A*		
Level of education reported					
Income for previous year					
Number of current household members					
Age of youngest child living at home					
Symptoms of pesticide poisoning	C*		C*		
Health problems that have necessitated an end to pesticide usage					

A* = Significant at .05 level of probability for apple growers.
Null hypothesis rejected.

C* = Significant at .05 level of probability for corn growers.
Null hypothesis rejected.

A profile seems to be emerging in the data which points to two types of pesticide applicators. One type could be classified as a risk taker and the other as a risk avoider.

Based on the Pearson product moment correlation matrix the risk taker is one who does not engage in protective health actions with regard to pesticides and clothing. This is the person who is likely to

1. Agree that one can't avoid risks.
2. Agree risks are just part of the job.
3. Agree that lots of things on the farm are far more dangerous than pesticides.
4. Agree one can't avoid pesticide on one's clothing.
5. Agree that pesticide often gets on their clothing.
6. Disagree that clothes keep pesticide off the skin.
7. Agree that pesticide gets through the clothing to the skin.
8. Agree that people are tough enough to take exposure to pesticide without harm.
9. Disagreed that pesticide on the skin will cause long-term harm.
10. Disagree that long-term harm will be serious.
11. Believe that the benefits of pesticides far exceed the risk.
12. Apply pesticides more days per year.
13. Report illness symptoms after working with pesticides.

The applicator who is described as a risk avoider is one who did engage in protective clothing actions with regard to pesticides. The correlation matrix indicates that this person is likely to

1. Be aware of the variations in pesticide toxicity.
2. Report getting pesticides on clothing worn.
3. Believe the clothing that is worn is effective in protecting from pesticides.
4. Agree that clothes keep pesticide off the skin.
5. Agree that pesticides don't get through the clothing to the skin.
6. Disagree that people are tough enough to take exposure to pesticides without harm.
7. Agree that one shouldn't go into the house wearing pesticide soiled clothing.
8. Agree that there is a likelihood of immediate health risk.
9. Agree that there is a likelihood of long-term harm.
10. Be an older applicator.
11. Report fewer illness symptoms.

Factor analysis began with a thirty-four item correlation matrix which was factored by means of the principal components analysis method of factor extraction (p. 45). Factor loadings of .500 or greater were used to identify the items that were assigned to each factor in the final six-factor rotated matrix which is reported in this chapter. Eigenvalues are all greater than one. Data from corn and apple growers was analyzed separately. Tables 34 (apple growers) and 35 (corn growers) report the factor loadings, communality, eigenvalues and percent variation for the six factors extracted.

The factor analysis of questionnaire items suggests that dimensions of the model are represented in the six factors. Items which make up the six factors are similar, but not identical, for corn and apple growers. The model dimensions of perception of risk, benefits and barriers, modifying factors, and protective health actions are reflected in the six factors. Table 36 and Table 37 list the variables which loaded at .5 or greater for the six factors.

The five items comprising Factor I were included in the perception of risk part of the model. The first four variables were defined as reflecting susceptibility and seriousness in the model. The fifth variable was included in the objective part of perception of risk.

Table 34.--Factor Loadings for Apple Growers

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	COMMUN-ALITY
Yrs. applied pest.	-.36742	-.59454	-.17439	.20676	.16631	.04045	.59093
Toxicity of pest. used last 2 yrs.	-.00597	-.16112	.00454	.24316	.58912	-.23724	.48848
Toxicity of insect. gets on clothes.	-.17673	.01200	.56097	.12368	.29720	.15926	.47505
Toxicity of pest. gets on clothes.	-.02628	.17289	.66591	-.02395	.04595	.02193	.47718
Pest. gets thru clothes to skin.	-.03978	.53842	.08785	.15446	.10706	.26617	.40536
Change after liq. concentrate spill.	.17281	-.02318	-.00560	.96696	.18834	-.01396	1.00111
Change after spray saturation.	-.06797	.08165	.27480	.67823	-.21702	.09651	.60320
Clothing effective in protection.	-.16878	.79053	-.00061	.05299	.18306	.13074	.70684
Likelihood immediate health risk.	.65094	-.11637	-.14197	.12019	-.07250	-.25195	.54061
Likelihood long-term harm.	.87957	.06987	-.11661	.02851	.14860	.05470	.81801
Clothes keep pest. off skin.	.02869	.26094	-.35882	-.08577	-.18305	.59590	.59363
Seriousness of long-term harm.	.82259	.10168	-.04667	.06409	.13457	.07177	.71653
Rate health risk.	.61459	.23617	-.18317	.01221	.47349	.28930	.77509
Can't avoid pest. on clothes.	-.04633	-.09554	.74900	.06147	-.08722	-.06853	.58836
Lots of things more dangerous on farm.	.30181	.04994	-.05884	-.18979	.68930	.07972	.61455
Applicator's age.	-.25895	-.68201	.03386	.09004	-.01340	.50583	.79750

	Eigenvalue	% Variation	Cummulative %
Factor 1	3.48145	29.6	29.6
Factor 2	2.15931	18.3	47.9
Factor 3	1.99757	17.0	64.8
Factor 4	1.58174	13.4	78.3
Factor 5	1.34294	11.4	89.7
Factor 6	1.21686	10.3	100.0

Table 35.--Factor Loadings for Corn Growers

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	COMMUN-ALITY
Yrs. applied pest.	.15193	-.02084	.01707	.88731	-.11885	-.12561	.84102
Days per yr. apply pesticides.	.53793	.17631	.06791	.20715	.01051	-.11120	.38046
Toxicity of other pest. gets on clothes.	.04850	.69067	-.17870	-.06684	.02029	.00064	.51619
Change after liq. concentrate spill.	-.01265	.19251	.08553	-.07592	-.03772	.65780	.48442
Change after spray saturation.	.04549	-.09901	.17730	.00355	-.09327	.65516	.48125
Likelihood immediate health risk.	.56065	-.48444	-.28755	-.18263	.23783	-.07961	.72795
Likelihood long-term harm.	.80590	-.20355	-.11088	-.22345	.05429	.04785	.75836
Seriousness of long-term harm.	.68571	.04654	-.08076	-.16075	.15906	.00501	.53005
Rate health risk.	.65741	.10188	.16365	-.00010	.10572	.01601	.48078
Crop yield benefit.	.23402	-.01149	.75818	.06100	-.14320	-.01196	.65411
Don't go in house wearing pest. soiled clothing.	.11013	.04813	.07500	-.02878	.95062	.03127	.92555
Benefits exceed risks.	-.15525	-.13306	.72261	-.07166	-.00909	.21130	.61384
Applicator's age.	-.28939	-.19941	-.02672	.58568	.12052	.09453	.49070

	Eigenvalue	% Variation	Cummulative %
Factor 1	3.14748	30.6	30.6
Factor 2	1.84590	17.9	48.5
Factor 3	1.66907	16.2	64.7
Factor 4	1.47303	14.3	79.0
Factor 5	1.11915	10.9	89.9
Factor 6	1.03762	10.1	100.0

Factor II reflects an objective perception of risk. Toxicity of other pesticides used most frequently in the last two years was the only variable to load above .50 in this factor.

Factor III appears to be related to barriers to action in the model. Strong belief in the necessity for pesticides for a good crop yield and the benefits of pesticides may provide a barrier to taking protective actions with respect to clothing.

Factor IV is made up of modifying factors. It is quite logical to see the years applying pesticides and an applicator's age cluster together. The more years one has applied pesticides the older one would be.

Factor V pertains to an attitude about a protective health action and an action. The question was not asked if one did in fact "not go into the house wearing pesticide soiled clothing". The statements dealing with going into the house and storing soiled laundry separate showed a moderate, negative correlation (p. 71) for both corn and apple growers.

Factor VI includes two protective health actions. Both deal with the time that the applicator reported for changing clothing after either a full strength liquid concentrate spill or becoming saturated with spray.

Factor I for apple growers again is related to the dimension of perception of risk. It is made up of the

Table 36.--List of Variables Loading at .50 or Greater for Corn Grower Factors.

Item	Loading
Factor I	
Likelihood of pesticide causing long-term harm.	.806
Seriousness of long-term harm	.686
Rate health risk associated with pesticide application.	.657
Likelihood of pesticide causing immediate health risk.	.561
Days per year apply pesticides.	.538
Factor II	
Toxicity of other pesticides used most frequently in the last two years.	.691
Factor III	
Rate crop yield benefit associated with pesticide application.	.758
Benefits of pesticide far exceed whatever risks there are.	.723
Factor IV	
Years Applied Pesticides.	.887
Applicator's Age	.586
Factor V	
People should never go into the house wearing pesticide soiled clothing.	.951
Store soiled garments separate from family laundry.	-.449
Factor VI	
Time reported to change clothing after spilling full strength liquid concentrate.	.658
Time reported to change clothing after clothing saturated with pesticide spray.	.655

Table 37.--List of Variables Loading at .50 or Greater for Apple Grower Factors

Item	Loading
Factor I	
Likelihood of pesticide on skin causing long-term harm	.880
Seriousness of long-term harm	.823
Likelihood of pesticide causing immediate health risk	.651
Rate health risk associated with pesticide application	.615
Factor II	
Evaluation of effectiveness of clothing worn for protection	.791
Applicator's age	-.682
Years applying pesticides	-.595
Pesticide gets through clothes to skin	.538
Factor III	
People can't avoid getting pesticide on their clothing	.749
Toxicity of other pesticide most frequently gets on clothes	.666
Toxicity of insecticide most frequently gets on clothes	.561
Factor IV	
Time reported to change clothing after spilling full strength liquid concentrate	.967
Time reported to change clothing after clothing saturated with pesticide spray	.678
Factor V	
Lots of things more dangerous on farm than pesticides.	.689
Toxicity of insecticide used most often in last two years.	.589
Factor VI	
Clothes keep pesticide off the skin	.596
Applicator's age	.506

same four variables that deal with susceptibility and seriousness as Factor I for corn growers. Days per year did not load in Factor I for apple growers.

Factor II is comprised of four variables, two of which are related to clothing as a barrier to pesticides. Applicator's age and years applying pesticides load together but both are negative this time. Evaluation of the effectiveness of clothing worn for protection and whether or not pesticide gets through clothes to the skin are included in this factor.

Factor III includes two statements about the toxicity of chemicals which get on clothing and the belief that people can't avoid getting pesticide on their clothing.

Factor V combines the attitudinal statement that lots of things are more dangerous on the farm than pesticides and the toxicity of the insecticide used most often in the last two years.

Factor VI clusters an attitude about clothing, clothes keep pesticide off the skin, with the applicator's age.

The results of the factor analysis suggest that the attitudes expressed by corn and apple pesticide applicators are reflected in the dimensions identified as part of the Protective Health Action model. Factor I for both corn and apple growers is substantially the same. While other factors are not identical it appears that they are very similar. Further factor analysis, using a larger sample, would strengthen the support for the relationships between the dimensions of the model and the questionnaire items.

CHAPTER V

SUMMARY, CONCLUSIONS, LIMITATIONS AND IMPLICATIONS FOR RESEARCH

This chapter includes the summary of the study, conclusions, limitations, and implications for further research.

Summary

Purpose

The primary focus of this study was to explore actions and attitudes of Michigan corn and apple growers with regard to pesticides and clothing. Specific research objectives were:

1. Gather baseline information about applicators' selection, storage, and wearing practices for pesticide soiled clothing.
2. Determine if there are differences between corn and apple growers with respect to demographic variables, experience and use of pesticides, clothing and laundry practices, and toxicity and formulation of pesticides that are reported to get on clothing which is worn while applying pesticides.
3. Explore a model which explains actions taken with respect to pesticide soiled clothing.

Methodology

This investigation was part of the larger North Central Region Project 170. "Limiting Pesticide Exposure Through Textile Cleaning Procedures and Selection of Clothing". The sample for this investigation was 150 corn growers and 72 apple growers who applied pesticides within the last two years of the survey and completed the applicator section of the questionnaire.

Data was analyzed using the SPSS computer package which provided descriptive statistics, two-tailed independent t-tests, Pearson Product Moment correlations and factor analysis.

Findings

No significant differences were found between Michigan corn and apple growers in regard to age, years of education, income, family size, ages of children living at home under the age of eighteen, laundry storage of pesticide soiled clothing, and the length of time reported that non-waterproof clothing saturated with spray was worn. There were significant differences in the number of years that corn and apple growers have applied pesticides, the days per year that corn and apple growers apply pesticides, the toxicity of the pesticides used in the last two years, the kind of clothing that is worn, the length of time reported to change non-waterproof clothing soiled with full strength liquid concentrate, and the toxicity of the pesticide most often reported getting on applicator's clothing.

The typical pesticide applicator, both corn and apple, is likely to wear a long sleeved shirt, jeans cr work pants, leather shoes, waterproof vinyl or rubber gloves, and a company or baseball style hat. In six out of seven categories of clothing listed, over fifty percent of both corn and apple growers stored pesticide soiled types of laundry separate from the other family laundry. Only underwear was stored over fifty percent of the time with the family laundry.

Over seventy percent of corn and apple growers reported that they do not wear pesticide soiled garments again before they are laundered. However, a small percentage of applicators do wear soiled clothing up to ten days. Both groups reported similar actions concerning the length of time it takes to change clothing which has become saturated with pesticide spray or soiled with full strength liquid concentrate. Less than twenty percent reported they don't spill pesticides on themselves. Approximately fifty percent of both groups report changing in three hours or less.

Components of a Model to Predict Protective Health Actions were explored. The model is composed of General Health Motivations, Perception of Risk, Benefits vs Barriers, Modifying and Enabling Factors, and Protective Health Actions. Significant correlations were found among variables making up each component and at least one of the Protective Health Actions.

Factor analysis suggests that there are underlying patterns of relationships in the variables of the data which reflect some of the dimensions of the model. The six factors identified are not identical for corn and apple growers. However, many of the same variables are found in both sets of factors. Further analysis may lead to the construction of questions which will more accurately tap the dimensions of the model.

Based on the correlation data a profile of two types of pesticide applicators seem to have emerged. They are tentatively identified as, the Risk Taker and the Risk Avoider, with regard to protective clothing actions.

The individual identified as a Risk Taker did not report taking protective clothing actions. Significant correlations were observed between this type of pesticide user and the belief one can't avoid risks, getting pesticides on clothing, perception of susceptibility to harm from pesticides, belief in the seriousness of harm from pesticides, days per year applying pesticides, the belief that the benefits of pesticides far exceed the risks, and reported illness symptoms after working with pesticides.

The applicator who is labeled as a Risk Avoider did comply with protective clothing actions. Significant correlations were found between this profile and the belief that one shouldn't go into the house wearing pesticide soiled clothing, belief that one is susceptible to health risk, belief that harm from pesticides is serious, applicator's age, and fewer illness symptoms. According to the model this is an individual who is in the "readiness to act" state. For both corn and apple growers, more applicators can be classified as Risk Takers.

Conclusions

The following conclusions are based upon the results of data analysis and hypothesis testing.

Based on the significant differences in experiential variables found between corn and apple growers the decision was made to look at the pesticide applicators as two separate groups.

Both corn and apple growers wear similar kinds of clothing while applying pesticides.

Clothing actions reported in regard to soiled clothing were similar for corn and apple growers.

Generally, components of the Protective Health

Action model correlated moderately with at least one clothing action.

Factor analysis suggests that there is a patterning in the variables of the study that may encompass the dimensions of the model. The six factors that emerged from the data reduction indicate that a more concise, smaller set of questions may be developed which will account for the interrelationships observed in the data.

Data from the study suggests that there are two types of pesticide applicators who responded to the questions, the Risk Taker and the Risk Avoider.

Limitations

On the basis of this investigation, the following limitations and research recommendations are offered:

Generalization of the findings are limited to the population represented by the respondents, Michigan corn and apple growers. However, it is reasonable to expect some commonality among farmers across the different types of crops grown.

Responses to a survey questionnaire may not reflect the actual actions and attitudes of this group. Michigan farmers are constantly being questioned about all facets of their occupation and fear that more government regulations may result from any data collected.

Two general attitudes about pesticides and protective health actions seem evident in the emergence of the risk taker and risk avoider profiles from the data. The relationships between the components of the model and the clothing actions may have been clearer if the data had been analyzed on the basis of attitudes rather than crops.

The questionnaire was not specifically written to test a model. The number of questions that represented the components of the model was not sufficient.

Discussion of Implications for Further Research

Obvious limitations exist when utilizing data from a questionnaire that was not designed to specifically represent the dimensions of the Protective Health Model. It is recommended that further research be devoted to developing valid and reliable questions and scales which can be used to solicit data from respondents which will define and expand the model. Further development of the model would be enhanced by considering the ecosystem principles.

The Protective Health Action Model stresses that actions result when attitudes and beliefs of an individual create a state of "readiness to take action" for that individual. Based on analysis thus far, a profile of a risk taker and risk avoider seems to be present in the variables which make up the "readiness to take action" part of the model. Whether or not an applicator engaged in protective health actions correlated with the category to which one belonged.

The risk taker did not engage in protective clothing actions. One wonders therefore about the perceptions of the person identified as a risk taker. Do Michigan corn and apple growers perceive an immediate and serious risk to their health from pesticides? Do growers have any first hand experience in dealing with illness which can be directly attributed to pesticides? Is clothing viewed as a means of protection from pesticide poisoning? Judging from the responses in this survey very few have experienced any serious health problems. While laboratory studies have established toxicity levels, agricultural producers do not directly link illness and the use of most pesticides.

Another explanation for this lack of perception of risk may be cognitive dissonance. The knowledge that pesticides are harmful to one's health and the belief in the benefit of their use may be very hard to reconcile. So the individual rationalizes by believing that "most applicators are tough enough to take pesticide exposure" (and I'm one of the tough ones).

Protective clothing has been identified as a method of safety protection for workers using pesticides. However, clothing actions are only one aspect of protective health behavior. The care in handling a pesticide when mixing and loading and the protection of an enclosed cab may be viewed as more important to the applicator than the clothing related actions listed in the questionnaire. The individual may perceive little risk because other precautions or protective actions not covered in this study are taken.

Pesticides are only one type of risk that an agricultural worker faces. Injury from animals, machinery accidents, illness from weather, and the stress of being a farmer in today's economy may have greater impact on perception of risk and health related problems than do pesticides. These were not included in this study.

Development of better textile products, safer chemicals, and other technological advances can all decrease the risk to which an agricultural worker is exposed. However, the utilization of the Protective Health Action Model may serve as a vehicle for educational programs to develop specific health and safety specific strategies for individuals and groups. With the development and testing of questions that are reliable and valid in identifying an individual's risk profile, programs could be planned that would address the reasons for protective actions. A computer game which leads the participant through a series of questions based on the dimensions of the model may help individual's identify their attitudes about risk and health.

The complexity of human attitudes and beliefs makes it difficult to explain an individual's health related behavior. But it is vitally important in today's complicated world to address the problems of pesticides and health. Protective clothing has been identified as a means of providing protection from pesticides and other toxic chemicals. The Protective Health Action Model could provide a tool for clarifying and defining perceptions of risk and encouraging adoption of protective clothing and other clothing related actions.

APPENDICES

APPENDIX A

APPLICATOR PORTION OF QUESTIONNAIRE USED IN THIS STUDY

Clothes and Pesticides: What is the Relationship?

SURVEY OF PESTICIDE APPLICATOR FAMILIES

MICHIGAN STATE UNIVERSITY

COLLEGE OF HUMAN ECOLOGY — EAST LANSING • MICHIGAN • 48824
DEPARTMENT OF HUMAN ENVIRONMENT AND DESIGN

Dear Friends,

Information on the relationship between clothing and pesticide exposure is limited, especially with respect to the effects of different laundry methods on removal of pesticides. You are being invited to participate in a survey concerned with the use and care of clothing worn when applying pesticides. Our purpose is to learn about the kind of clothes worn when applying pesticides, where these clothes are stored after wearing, and what laundry procedures are used for cleaning them. The study is being conducted by Michigan State University Clothing and Textile researchers in conjunction with four other universities as part of a regional research project.

Results of this research will be used to direct laboratory experiments to determine more effective cleaning methods for clothing worn when applying pesticides. Your participation is totally voluntary. Your answers will remain confidential and will be summarized with responses of other persons similar to yourself for purposes of reporting. You may refuse to answer any question or set of questions. However, we hope you will complete the questionnaire to insure that we have the best information on which to base our laboratory studies.

The questionnaire has two parts. Each part should take no more that 15 minutes to complete. The first part should be completed by the adult in the family who uses pesticides most frequently. The second part should be completed by the adult who is usually responsible for doing the laundry. For purposes of this study, herbicides, fungicides, insecticides, and rodenticides are all considered to be pesticides.

If you have any questions about this survey, please call Ann Slocum or Lois Shern at (517) 355-3779. If no one in your family has applied any pesticides in the past two years, please return the blank questionnaire.

Thank you for your help in answering our questions.

Sincerely,

Ann C. Slocum

AS/lcs

(1-5, 6/1)

PART I: TO BE FILLED OUT BY THE ADULT WHO APPLIES PESTICIDES MOST OFTEN

SECTION A: EXPERIENCE WITH PESTICIDES

Q-1. Do you work with pesticides primarily as (check one)
(7)

1. _____ AN INDEPENDENT FARM OPERATOR
2. _____ A COMMERCIAL APPLICATOR
3. _____ OTHER (please specify) ____________________

Q-2. About how many years have you used or applied pesticides?
(8-9)

____
number of years

Q-3. About how many days each year do you work with pesticides?
(10-12)

____
number of days

Q-4. Have you used any of the following insecticides or other types of pesticides (herbicides, fungicides, and rodenticides) in the past two years?
(check all you have used)

(13-22)
INSECTICIDES [1]

1. _____ COUNTER
2. _____ DYFONATE
3. _____ FURADAN
4. _____ THIMET
5. _____ OTHER (please specify)

____

OTHER PESTICIDES

6. _____ ATRAZINE
7. _____ SUTAN
8. _____ DUAL
9. _____ LASSO
10. _____ OTHER (please specify)

____

(13-22)
PESTICIDES [2]

1. _____CYPREX (DODINE)
2. _____CAPTAN
3. _____POLYRAM
4. _____DIKAR
5. _____IMIDIAN
6. _____PLICTRAN
7. _____GUTHION
8. _____OTHER (please specify)

____

[1] Corn growers questionnaire.

[2] Apple growers questionnaire.

Q-5. Which insecticide have you used in the greatest quantity in the past two years? (list one)

(23)

____

A. What was the formulation of the insecticide listed in question 5? (check one)

(24)

1. _____GRANULAR
2. _____POWDERED
3. _____LIQUID
4. _____OTHER (please specify) _______________
5. _____DON'T KNOW

B. How was this insecticide applied? (check one)

(25-26)

1. _____FIXED WING AIRCRAFT
2. _____BOOM SPRAYER
3. _____HYDRAULIC SPRAYER
4. _____AIR BLAST SPRAYER
5. _____LOW VOLUME AIR SPRAYER
6. _____ULTRA-LOW VOLUME SPRAYER
7. _____FOGGER
8. _____DUSTER
9. _____GRANULE SPREADER
10. ____SOIL INJECTOR
11. ____HAND EQUIPMENT
12. ____OTHER (please list) _______________

Q-6. What other type of pesticide (herbicide, fungicide, or rodenticide) have you used in the greatest quantity in the past two years? (list one)

(27)

____

A. What was the formulation of the pesticide listed in question 6? (check one)

(28)

1. _____GRANULAR
2. _____POWDERED
3. _____LIQUID
4. _____OTHER (please specify) _______________
5. _____DON'T KNOW

B. How was this pesticide applied? (check one)

(29-30)

1. _____FIXED WING AIRCRAFT
2. _____BOOM SPRAYER
3. _____HYDRAULIC SPRAYER
4. _____AIR BLAST SPRAYER
5. _____LOW VOLUME AIR SPRAYER
6. _____ULTRA-LOW VOLUME SPRAYER
7. _____FOGGER
8. _____DUSTER
9. _____GRANULE SPREADER
10. ____SOIL INJECTOR
11. ____HAND EQUIPMENT
12. ____OTHER (please list) _______________

SECTION B: PESTICIDES AND CLOTHING

Q-7. (31) Which brand of insecticide most frequently gets on your clothes? (PLEASE ANSWER QUESTIONS 9 THROUGH 15 IN TERMS OF THIS INSECTICIDE)

____

0. _____ INSECTICIDE NEVER GETS ON CLOTHES

Q-8. (32) What other type of pesticide (herbicide, fungicide, or rodenticide) most frequently gets on your clothes? (IF YOU NEVER GET INSECTICIDE ON YOUR CLOTHES, PLEASE ANSWER QUESTIONS 9 THROUGH 15 IN TERMS OF THIS OTHER TYPE OF PESTICIDE)

____

0. _____ OTHER PESTICIDES NEVER GET ON CLOTHES

↓

GO TO QUESTION 9 IF INSECTICIDE GETS ON CLOTHES.
GO TO QUESTION 16 IF NEITHER INSECTICIDE NOR OTHER PESTICIDES GET ON CLOTHES.

Q-9. (33) How often would you say pesticide gets on your clothes? (check one)

1. _____ SELDOM (about once per application season)
2. _____ SOMETIMES (two or three times per application season)
3. _____ USUALLY (about once a week during application season)
4. _____ ALWAYS (nearly every day)
5. _____ DON'T KNOW

Q-10. (34) When pesticide gets on your clothes, how often does it get through the clothing to the skin? (check one)

1. _____ NEVER
2. _____ SELDOM (about once per application season)
3. _____ SOMETIMES (two or three times per application season)
4. _____ USUALLY (about once a week during application season)
5. _____ ALWAYS (nearly every day)
6. _____ DON'T KNOW

Q-11. What clothing do you usually wear when applying pesticide? Check all that apply in each category of clothing (A-F) listed below.

A. WORK OR SPORT SHIRTS
(35-38)
1. _____ LONG SLEEVES
2. _____ SHORT SLEEVES
3. _____ SLEEVELESS
4. _____ DO NOT USUALLY WEAR

B. PANTS
(39-43)
1. _____ COVERALLS WITH LONG SLEEVES
2. _____ BIB OVERALLS
3. _____ JEANS OR WORK PANTS
4. _____ SWEAT PANTS
5. _____ SHORTS, CUTOFFS

C. WORK SHOES/BOOTS
(44-47)
1. _____ WATERPROOF VINYL/ RUBBER
2. _____ LEATHER
3. _____ CANVAS
4. _____ OTHER (describe)

____

D. GLOVES
(48-52)
1. _____ WATERPROOF VINYL/ RUBBER
2. _____ LEATHER
3. _____ CANVAS
4. _____ OTHER (describe)

____

5. _____ DO NOT USUALLY WEAR

E. HATS
(53-58)
1. _____ HARD PLASTIC
2. _____ FELT
3. _____ STRAW
4. _____ COMPANY/BASEBALL
5. _____ OTHER (describe)

____

6. _____ DO NOT USUALLY WEAR

F. OTHER CLOTHES
(59-68)
1. _____ JACKET OR COAT
2. _____ SWEATSHIRT
3. _____ SLEEVELESS VEST
4. _____ UNDERSHIRT
5. _____ JOCKEY/BOXER SHORTS
6. _____ SOCKS
7. _____ BELT
8. _____ WATERPROOF JACKET
9. _____ WATERPROOF PANTS
10. _____ OTHER (describe)

____

Q-12. When pesticide comes in contact with your clothes, is it usually (check one)

(69-70)

1. _____ GRANULAR
2. _____ POWDERED
3. _____ LIQUID ⟶ 12a. Is the concentration usually (check one)
   1. _____ DILUTED TO FIELD CONCENTRATION
   2. _____ FULL STRENGTH
   3. _____ OTHER (explain) _______________
   4. _____ DON'T KNOW
4. _____ OTHER (explain) _______________
5. _____ DON'T KNOW

Q-13. Do you usually wear clothes soiled with pesticide again before they are laundered? (check one)

(71-74)

1. _____ YES (give average number of days of wearing) _____ days
2. _____ NO

Q-14. If you are not wearing waterproof clothing and you spill the full strength liquid concentrate of pesticide on your clothes, do you usually change them immediately (within an hour)? (check one)

(75-76)

1. _____ NOT APPLICABLE ⟶ [GO TO QUESTION 15]
2. _____ YES ⟶ [GO TO QUESTION 15]
3. _____ NO ⟶ 14a. How soon do you change clothes? (check one)
   1. _____ 1 TO 3 HOURS
   2. _____ 4 TO 6 HOURS
   3. _____ 7 OR MORE HOURS

Q-15. If you are not wearing waterproof clothing and your clothes become saturated with spray during application of pesticide do you usually change them immediately (within an hour)? (check one)

(77-78)

1. _____ NOT APPLICABLE ⟶ [GO TO QUESTION 16]
2. _____ YES ⟶ [GO TO QUESTION 16]
3. _____ NO ⟶ 15a. How soon do you change clothes? (check one)
   1. _____ 1 TO 3 HOURS
   2. _____ 4 TO 6 HOURS
   3. _____ 7 OR MORE HOURS

(1-5, 6/2)

Q-16. Where do you usually store clothing worn for pesticide application before it is washed? (check one answer for each type of clothing)

(7-9)

	With other family laundry	Separate from other family laundry
a. shirts, jean, workpants ...	1._______	2._______
b. underwear	1._______	2._______
c. jackets, coveralls.........	1._______	2._______

Q-17. Where do you usually store other items worn for pesticide application until next use? (check one answer for each type of item).

(10-13)

	With other family clothing	Separate from other family clothing
a. boots, shoes	1._______	2._______
b. hats, caps	1._______	2._______
c. gloves	1._______	2._______
d. belts	1._______	2._______

Q-18. How effective do you feel the clothes you usually wear are in protecting you from pesticide exposure? (circle one)

(14)

VERY EFFECTIVE						VERY INEFFECTIVE
1	2	3	4	5	6	7

SECTION C: PESTICIDES AND HEALTH

Q-19. How likely is it that getting pesticides on your skin will cause an immediate health risk? (circle one)

(15)

VERY LIKELY						VERY UNLIKELY
1	2	3	4	5	6	7 → GO TO QUESTION 21

Q-20. How serious do you think that immediate health risk is apt to be? (circle one)

(16)

VERY SERIOUS						VERY MILD
1	2	3	4	5	6	7

Q-21. How likely is it that getting pesticides on your skin will cause long-term harm? (circle one)

(17)

VERY LIKELY						VERY UNLIKELY
1	2	3	4	5	6	7

7 → [GO TO QUESTION 23]

Q-22. How serious do you think that long-term harm is apt to be? (circle one)

(18)

VERY SERIOUS						VERY MILD
1	2	3	4	5	6	7

Q-23. With over-exposure to some pesticides there is danger of poisoning. After working with pesticides how often would you say you have experienced the following? (circle one answer for each item)

(19-36)	ALWAYS	USUALLY	SOMETIMES	SELDOM	NEVER
UNUSUAL TIREDNESS......	1	2	3	4	5
HEADACHE...............	1	2	3	4	5
DIZZINESS..............	1	2	3	4	5
EYE IRRITATION.........	1	2	3	4	5
BLURRED VISION.........	1	2	3	4	5
NOSE BLEEDS............	1	2	3	4	5
NAUSEA.................	1	2	3	4	5
VOMITING...............	1	2	3	4	5
STOMACH CRAMPS.........	1	2	3	4	5
DIARRHEA...............	1	2	3	4	5
WEAKNESS...............	1	2	3	4	5
CHEST DISCOMFORT.......	1	2	3	4	5
DIFFICULTY BREATHING...	1	2	3	4	5
MUSCLE TWITCHES........	1	2	3	4	5
SKIN IRRITATION........	1	2	3	4	5
FAST HEART RATE........	1	2	3	4	5
EXCESS SWEATING........	1	2	3	4	5
FEVER..................	1	2	3	4	5

Q-24. Have you stopped using any pesticide because of health related problems? (check one)

(37-47)

1. _____ YES ⟶ 24a. If yes, please list the pesticide and the related problem.

2. _____ NO

Pesticide	Health Problem
__________	__________
	__________
__________	__________
	__________

Q-25. Overall, for you personally, how would you rate the health risk associated with pesticide application? (circle one)

(48)

VERY HIGH ... VERY LOW

1 2 3 4 5 6 7

Q-26. Overall, for you personally, how would you rate the crop yield benefit associated with pesticide application? (circle one)

(49)

VERY HIGH ... VERY LOW

1 2 3 4 5 6 7

SECTION B: OPINIONS ABOUT PESTICIDES. We would like to ask you for your opinions concerning use of pesticides. Do you STRONGLY AGREE (SA), AGREE (A), ARE NOT SURE (NS), DISAGREE (D), or STRONGLY DISAGREE (SD) with the following statements. Circle one answer for each statement.

		SA	A	NS	D	SD
Q-27. (50)	Clothes keep pesticide off the skin.	1	2	3	4	5
Q-28. (51)	Pesticides differ in their level of toxicity-some are very dangerous and others are not.	1	2	3	4	5
Q-29. (52)	Most people are tough enough to take exposure to pesticides without harm.	1	2	3	4	5
Q-30. (53)	People really can't avoid getting pesticide on their clothes if they farm nowadays.	1	2	3	4	5
Q-31. (54)	Insecticide should be used only when monitoring of the insects indicates it is needed.	1	2	3	4	5

		SA	A	NS	D	SD
Q-32. (55)	People should never go into the house wearing clothes that have pesticide on them.	1	2	3	4	5
Q-33. (56)	Pesticides are not harmful if they are handled properly.	1	2	3	4	5
Q-34. (57)	There are lots of things on the farm that are far more dangerous than pesticide.	1	2	3	4	5
Q-35. (58)	The benefits of pesticides far exceed whatever risks may be involved.	1	2	3	4	5
Q-36. (59)	The risk involved in getting pesticide on clothes is nothing compared to breathing pollution in the air.	1	2	3	4	5
Q-37. (60)	It is better to pay someone else to apply pesticide and avoid the health risk.	1	2	3	4	5
Q-38. (61)	Risks are just part of the job in pesticide application.	1	2	3	4	5

SECTION E: This section contains some questions we need to ask about you and others who live in your household. This information will be kept confidential, but will be helpful to us in interpreting the information you have already provided.

Q-39. Please list everyone living in your household, starting with yourself, and indicate age and sex for each.
(62-89)

PERSONS IN HOUSEHOLD (myself, spouse, son, daughter, etc.)	AGE	Circle one: M=male F=female	
____________________	______	M	F
____________________	______	M	F
____________________	______	M	F
____________________	______	M	F
____________________	______	M	F
____________________	______	M	F
____________________	______	M	F
____________________	______	M	F

Q-40. How many years of schooling have you completed? (check one)
(7)

1. _____LESS THAN 8 GRADES
2. _____8 GRADES OF ELEMENTARY SCHOOL
3. _____1-3 YRS. OF HIGH SCHOOL
4. _____COMPLETED HIGH SCHOOL
5. _____COMPLETED JR. COLLEGE, TRADE OR VOCATIONAL SCHOOL (2 yr. program)
6. _____1-3 YRS. COLLEGE
7. _____COMPLETED COLLEGE (4 yr. degree)
8. _____GRADUATE DEGREE OR PROFESSIONAL DEGREE
9. _____OTHER (please explain) ______________________________

Q-41. About how many acres of land do you farm? (check one)
(8)

1. _____10-200
2. _____201-400
3. _____401-600
4. _____601-800
5. _____801-1000
6. _____1001 or more

Q-42. Which of the following categories best describes your total family income before taxes during 1983? (check one)
(9-10)

1. _____less than $5000
2. _____$5000 to $9,999
3. _____$10,000 to $14,999
4. _____$15,000 to $19,999
5. _____$20,000 to $29,999
6. _____$30,000 to $39,999
7. _____$40,000 to $49,999
8. _____$50,000 to $59,999
9. _____$60,000 to $69,999
10. _____$70,000 to $79,999
11. _____$80,000 to $89,999
12. _____$90,000 or more

Thank you very much for providing information on pesticide application and clothing practices. If there is any additional information that you feel would be helpful to us, please add it below.

APPENDIX B

LETTER TO PARTICIPANTS FROM PROJECT DIRECTOR

MICHIGAN STATE UNIVERSITY

COLLEGE OF HUMAN ECOLOGY
DEPARTMENT OF HUMAN ENVIRONMENT AND DESIGN

EAST LANSING · MICHIGAN · 48824

March 12, 1984

Dear Friends,

Several weeks ago I wrote to you seeking information on the use and care of clothing worn when applying pesticides. As of today we have not received your completed questionnaire.

At present, information about the relationship between clothing and pesticide exposure is limited. Responses to our research will be used to direct laboratory studies to determine more effective cleaning methods for clothing worn when applying pesticides.

I am writing to you again because of the significance each questionnaire has to the usefulness of the study. Your name was drawn through a scientific sampling process that produces a small but representative sample of Michigan applicators. In order for the results of this study to be truly representative of the responses of Michigan applicators, it is essential that each household in the sample return their questionnaire. As mentioned in our first letter the questionnaire has two parts. The first part should be completed by the adult in the family who uses pesticides most frequently, the second part should be completed by the adult who is usually responsible for the laundry.

We are looking forward to receiving your completed questionnaire. In the event your questionnaire has been misplaced, please check the appropriate box on the enclosed postcard. If you are not eligible to participate because you are retired or hire a commercial applicator we would appreciate your indication of this on the postcard. No postage is necessary for the postcard. Just drop it in the mail.

Your cooperation is greatly appreciated. Thank you.

Sincerely.

Ann C. Slocum

Ann C. Slocum
Project Director

ACS/lcs

APPENDIX C

RESPONDENT'S RETURN POSTCARD

☐ We have misplaced our copy of the questionnaire. Please send another copy.

☐ We hire commercial applicators to apply our pesticides.

☐ We are retired and no longer apply pesticides.

☐ We do not use pesticides in our farming operations.

71-6552

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 141 EAST LANSING, MI.

POSTAGE WILL BE PAID BY ADDRESSEE

Ann C. Slocum
214 Human Ecology
Michigan State University
East Lansing, MI 48824

APPENDIX D

PROTECTIVE CLOTHING INDEX

Appendix D - Protective Clothing Index

	Area	Thickness	Range
Undershirt			
not worn	0	0	
worn	1	1	0-2
Shirt			
not worn	0	0	
sleeveless/short sleeve	1	1	
long sleeve	2	1	0-3
Coveralls			
not worn	0	0	
worn	2	1	0-3
Jacket			
not worn	0	0	
worn-not waterproof	2	2	
worn-waterproof	2	4	0-6
Vest			
not worn	0	0	
worn	1	2	0-3
Undershorts			
not worn	0	0	
worn	1	1	0-2
Pants			
cutoffs	1	1	
long-not waterproof	2	1	2-3
Waterproof pants			
not worn	0	0	
worn	2	4	0-6
Hats			
not worn	0	0	
worn-not waterproof	1	1	
worn-waterproof	1	3	0-4
Shoes			
canvas	1	1	
leather	1	2	
waterproof	1	3	2-4
Socks			
not worn	0	0	
worn	1	1	0-2
Gloves			
not worn	0	0	
worn-not waterproof	1	1	
worn-waterproof	1	3	0-4
Special Protective Clothing			
not worn	0	0	
worn	1	1	0-2
		Possible Range	4-44

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