THE EFFECT OF LIFESTYLE ON THE HEALTH OF THE AMISH IN WAYNE
AND HOLMES COUNTIES OF OHIO

A Thesis

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by

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* * * * *

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To My Wife Susan Winter Cobey
for Her Support and Patience
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Chapter I
Introduction

Problem Statement

The Amish have always been a people of the land (Kraybill, 1989). The agricultural lifestyle is a fundamental dogma of their religion. The book of Genesis from the Bible, where God condemns Adam to till the ground from which he was "created", provides the Amish with direct biblical reference to farming as their primary way of life. Furthermore, farming has allowed the Amish to establish a community structure which holds their people together. A persistent theme of the Amish is praise for the farm as the best place to raise a family (Kraybill, 1989). Yet despite this strong association with the soil, economics and land availability have forced the Amish to seek other occupations. In Wayne and Holmes Counties only 42% of the Amish population now list farming as their occupation, and not all of these are full-time farmers (Kreps, Kreps and Donnermeyer, 1992). In other areas of the state, the percentage of Amish listing farming as their occupation has declined to an even greater extent. In spite of these pressures and the resulting trends, farming continues to be an important part of the Amish community.

Farming practices of the Amish are an interesting mixture of old and new technology. They have adopted such
innovations as artificial insemination of dairy cattle, the use of pesticides, commercially hybridized seed and veterinarian medicines. On the other hand, the Amish continue to reject the use of tractors for field operation and modern farming machinery which offer protection from sun, dust and noise. During harvest, dust from the thrashing and cutting process often places these farmers in unprotected environments with potential exposure to high levels of organic dust and plant matter.

Generally, Amish farmers do not have modern livestock containment buildings, and thus rely on straw bedding to collect waste rather than a more mechanized livestock waste disposal system. Straw bedding systems require the farmers to spend a great deal of time in confined situations of elevated levels of organic gases, organic dust and mold spores. Many of the Amish operate small to moderate sized brood chick broiler poultry operations, which place them in situations of exposure to avian proteinaceous substances. Although the Amish may blow silage into silos using stationary tractors, they generally climb up into the silos on a daily basis to hand pitch silage from the silo. These practices place them in potential exposure situations to elevated levels of organic dust, mold spores and gases such as NOₓ (Nitrogen Oxide or Nitrogen Dioxide). Organic dust, mold spores and avian proteinaceous substances are all known causative agents for
hypersensitivity pneumonitis (Farmer's Lung) and toxic organic dust syndrome (TODS).

**Significance of the Problem**

Farmer's Lung is an allergic reaction of the lung arising from repeated inhalation of certain organic dusts. The primary antigenic agents are spores from certain species of mold and fungi. TODS is a non-allergic inflammatory response of the lungs, is relatively common, and often occurs simultaneously in a cluster of exposed persons. This is in direct contrast to Farmer's Lung, which is a fairly rare response of sensitized individuals. Farmer's Lung can become chronic, with some cases resulting in progressive irreversible damage to lungs leading to permanent disability or death (Mutel et al., 1986).

The Amish farmers are commercial operators and are interested in techniques which will increase their production. However, the bishops are concerned about permitting practices which may threaten the community structure and lifestyle. Thus, the Amish continue to practice farming techniques which may jeopardize their health and well-being.

Given the contrived separation (Olshan, 1981) that the Amish maintain with the outside (non-Amish) world, it is difficult to estimate the extent of many health and safety problems within the Amish community. In regard to occupational or lifestyle respiratory problems, it is possible to approximate the potential incidence within the Ohio Amish population.
Based on information obtained in the Holmes County Amish Directory (1988), there were approximately 1290 Amish farms in the Wayne and Holmes County area of Ohio (Donnermeyer et al., 1993). Jordan Fink (1986), in the NIOSH publication *Occupational Respiratory Diseases*, reports that researchers have found hypersensitivity pneumonitis as high as 9.6% in farming populations and as high as 15% in some avian operations. This would lead us to suspect that there would be at least 130 cases of Farmer's Lung in the Wayne/Holmes County Amish population. Undoubtedly, this would be a very conservative estimate which does not include children who perform farming duties from a relatively young age. Furthermore, the use of horse and buggies places even the non-farming Amish population in environments with causative agents which may place them at risk for hypersensitivity pneumonitis or TOS.

**Objectives of the Study**

The Amish do use modern medicines and health services, but are more likely to rely on home remedies and visit the doctor only as a last resort (Kraybill, 1989). Many of the symptoms from acute exposure to the causative agent of Farmer's Lung include chills, fever, cough, breathlessness and malaise, which may go unreported and are often viewed by the farmer and his family as nothing more than a touch of the flu. Similarly, sub-acute cases of hypersensitivity
pneumonitis include symptoms such as coughing, shortness of breath, easy fatigue and weight loss. This condition is often misdiagnosed due to lack of patient and/or physician awareness (Fink, 1986, Matel, et al., 1986).

This study seeks to investigate if there should be concern for elevated levels of hypersensitivity pneumonitis or TODS within the Ohio Amish population. Furthermore, this thesis will investigate how the Amish might respond to screening programs and procedures necessary to conduct further and more extensive surveys regarding this and other health related issues. In addition, the investigation attempts to explore how the Amish culture may affect the adoption of innovations in their occupational activities and lifestyle which may improve their overall health and well-being.

It is hypothesized that: Amish farmers will suffer a higher prevalence of reduced lung function, possibly hypersensitivity pneumonitis or Farmer's Lung, compared to non-farming Amish, and farming and non-farming non-Amish. Other occupations of the Amish (wood mills, carpentry, etc.) may also result in reduced lung function because of the high levels of wood dust. However, an alternative hypothesis would be that the Amish have fewer cases of reduced lung function due to less mechanized farming practices and more physical exercise. Their farming practices will produce less dust, less airborne mold spores and less organic gases which contribute
to reductions in lung capacity. At least in the less conservative sects, a lower incidence of smoking (Hostetler, 1993) may also contribute to improved lung function.

Before progressing further with the details of this study, it is important that a discussion of the Amish culture ensue. In this thesis, an exploration of how the Amish lifestyle may effect their health and well-being will be conducted. Furthermore, it will be of interest to at least raise the question of how investigators might work within the Amish culture to influence change if the primary hypothesis put forth in this thesis is supported. The following chapter should present a clear portrait of the Amish view, from a theoretical perspective, of the cultural practices which are of concern in this thesis. The discussion will not be limited to only those specific practices which may jeopardize their health and well-being. Rather, a generalization of their use of symbolic gestures to profess their identity and control the members of their community's behavior will be made.
Chapter II
Overview

Ohio has the largest Amish population in the United States, with approximately one-third of all Amish residing within the geographical boundaries of the state. The largest of the communities are located in the Wayne/Holmes and Geauga Counties; however, there are various Amish communities in twenty additional counties in Ohio. Pennsylvania and Indiana, respectively, represent the second and third largest populations in the United States. However, Amish communities can be found in twenty-one different states, including sizeable communities in Maryland, Michigan, Texas and Florida (Hostetler, 1993, Kraybill, 1989). It is important to note that the term “Amish” refers to a variety of groups, with various districts either being more or less conservative in their biblical interpretations and their acceptance of “modern conveniences” (use of the word Amish throughout this thesis implies Old Order unless otherwise stated).

The Amish sect traces its origins back to a group of Swiss Anabaptists\(^1\) who migrated to the United States through

\(^1\)A religious group which includes: Mennonites, Amish and Hutterites. They deny the validity of infant baptism and practice baptism of adults. The Anabaptists originated in Switzerland in 1525.
out the 1700’s (Hostetler, 1993). They are a Christian denom-
ination who avoid many modern conveniences that the non-Amish
(or "English", as referred to by the Amish) society employs.
As stated earlier, Ohio has the largest Old Order Amish pop-
ulation of any state in the United States, with an estimated
one-third (Hostetler, 1993) of the approximately 150,000
Amish in North America. Old Order Amish, the sole guardians
of traditional Amish culture, are by far the most conserva-
tive of the original Anabaptists descendants. Also known as
the "House Amish" because church services are conducted in
their homes, they maintain the greatest separation between
themselves and the outside world (Kraybill, 1989). They do
not operate automobiles, use electricity supplied by public
utilities, nor attend school past the eighth grade.

The importance of the land and farming to the Amish
have already been discussed. In spite of pressures and the
resulting trends that continue to force many Amish to pursue
non-agricultural careers, farming continues to be an impor-
tant part of the Amish community. One of the major forces af-
fecting their ability to remain with the land is the phenome-
nal population growth that the Amish are experiencing
(Hostetler, 1993). This may or may not influence the overall
percentage of Amish individuals with respiratory ailments.
However, the increase in population is an important enough
factor when looking at the Amish that it clearly warrants a
more detailed review.
The Amish place a very high value on their family and having children (Erickson, 1979, Hostetler, 1993, Kraybill, 1989). There is no divorce allowed in the Amish community (Erickson, 1979, Hostetler, 1993) and couples that do divorce are immediately excommunicated (Kraybill, 1989). Birth control of any kind, including the rhythm method or coitus interruptus, is prohibited and the Amish tend to have large families (Cross, 1970, Hostetler, 1993, Kraybill, 1989). The Amish are second only to the Hutterites, their Anabaptist cousins, in total fertility rate\textsuperscript{2} relative to other groups in the United States (Hostetler, 1993). Felt (1990) reported the total fertility rate for the Hutterites at 9.99 and the Old Colony Mennonites (in Mexico) at 9.87. Both of these groups appear to demonstrate natural fertility using no form of artificial birth control and evidently do not attempt to limit family size. The Amish, however, had a somewhat lower total fertility rate of 7.42 in Holmes County, Ohio. The Hutterites live in a communal setting and the duties of childcare are shared among the women of the community. The Old Order Mennonites in Mexico have autonomous family units similar to the Amish. The difference in the fertility rates between the Old Order Mennonite and the Amish is apparently the age at first marriage, 20.8 (Felt, 1990) and 22 years (Ericksen, 1979, Hostetler, 1993, Kraybill, 1989) respectively.

\textsuperscript{2}Total fertility rate is the average number of live births per woman.
By delaying marriage, the Amish are reducing the ultimate size of their families in a seemingly conscious decision to limit family size (Cross, 1970). Given the labor intensive farming practices of the Amish and that the age at marriage has not changed significantly for at least a century (Ericksen, 1979), it is likely that other social and cultural variables play a role in this decision. The Amish have longer birth intervals, at the lower-order births (the first pregnancies of a woman), than the Hutterites or the Old Order Mennonite women. This suggests that some of the Amish do control their fertility by means other than a delay in marriage (Felt, 1990). This may be explained in part by the length of time that the new mother actually breast feeds her child, which is known to inhibit the onset of ovulation. There is a tendency to switch to bottle feeding within a short time after birth (Ericksen, 1979) in both Amish and Hutterite communities. However, given the communal nature of childcare in the Hutterite community, the switch to bottle feeding apparently occurs at an earlier age. Ericksen (1979) demonstrated that average birth intervals are one to two months longer when the mother breast feeds intensively than when she does not.

The value that the Anabaptists, especially the Amish and Hutterites, place on procreation is readily apparent. The population table shown in Figure 1 (Hostetler, 1993) shows that the age composition of the Amish population is
considerably different than the general rural farm population. This reflects the Amish and rural-farm populations in Elkart and Lagrange Counties of northeastern Indiana. Populations from Holmes County, Ohio, show similar results (Cross, 1970).

The commitment of the Amish to having a large family is central to the community. However, the logarithmic population increase in the Amish community threatens its existence as it is know today. To thoroughly investigate the future of the Amish, a complete understanding of the demographic influences is essential.

Figure 1. Age Composition Profiles of Amish and Rural Farm Populations, Elkhart and LaGrange Counties, Indiana, in 1980. (Hostetler, 1993)
Social change has occurred throughout the history of the Amish. However, there are two basic fundamentals of the Amish community that have remained constant, first, is their religious doctrine of separation from the world and second, the conviction that members must be obedient to the sect’s teaching and leaders (Kraybill, 1989). Anything that is perceived as a threat to these cornerstones of the Amish community is rejected and forbidden by the bishops. There is a major conflict between these pillars (separation and obedience) of the Amish community which is becoming more pronounced.

Land values and the availability of rich farmland suitable for their intensive farming practices are making it far more difficult for the Amish to own arable land. The large Amish families provide a resource of labor necessary to sustain these operations. However, they compound the problem of finding suitable acreage for all the male children to remain in farming. There is some speculation that the Amish will have to change their philosophy on these principles (Ericksen, 1980).

One significant change is the number of Amish farmers who no longer earn their living by farming. Prior to 1954, Amish fathers in Lancaster, Pennsylvania, who sought employment in factories, were excommunicated (Hostetler, 1993). This type of action is no longer the case and, as stated earlier, less than half of the Amish list farming as their occupation, which is consistent with the findings of others.
in Pennsylvania (Hostetler, 1993). Kraybill (1989) has labeled this the “Lunch Pail Threat” and quotes a bishop who contended that “...the lunch pail is the greatest threat to our way of life.” The bishop has good reason to be concerned, for as Simmel (1971) points out, “...intensified individualization within the group is accompanied by decreased individualization of the group itself.” This point will be explored to a greater extent later, for individualization of the group is essential for the Amish to maintain their identity as an independent subculture.

The expansion of the population in the Amish community increases the effort to exclude all individual differences. This will become increasingly difficult and will threaten the individuals’ commitment to the group (Simmel, 1971). With less demand for labor to operate a farm, it would seem logical that the Amish would begin to restrict the size of their families. However, the Amish feel that removing the father from the farm will weaken his influence to instill Amish values on his children (Kraybill, 1989). Thus, the Amish continue to follow a path which may threaten their cultural independence. To do otherwise, however, could weaken their resolve in their beliefs which make them what they are, a unique American subculture.
Chapter III
Review of Literature

Theory

Kreps et al. (1992) asked two fundamental questions: (1) Will the Amish cease being "Amish" as more and more of their men and women engage in employment off the farm? (2) Can Amish society maintain its values and traditional lifestyle with a shrinking farm occupational base? Ericksen and Ericksen (1979, 1980) feel that it is impossible to remain Amish and not be involved in farming. A discussion of how the Amish have utilized certain aspects of conflict theory and symbolic interactionism to establish and maintain their cultural identity will help in the understanding of the Amish way of life.

The Anabaptists are and have always been a pacifistic people. Therefore, it is ironic how conflict has and continues to play such a dominant role in their social structure. Internal and external conflict have been evident from the first Anabaptist movement, when they formed a separate counterculture in the early sixteenth century. A counterculture is defined as a deviant group whose values are in conflict with those of the dominant culture (Yinger, 1982). The Anabaptists split from the Swiss Reform Church in 1527 to become a separate counterculture. A century and a half later
the Amish broke from the Mennonites in a less dramatic, though still a confrontational, manner. The following discussion highlights how conflict has played a major role in Amish history and the development of practices by which they maintain their separate identity.

The early sixteenth century was a time of major political, economic and religious turmoil (Chirot, 1986). For more than a thousand years, Western Europe had been united by the “One Holy Catholic and Apostolic Church.” In the sixteenth century, society was splintering and the Catholic Church began to lose moral and political authority in some parts of Europe. Two major dissenters were Martin Luther and Huldrych Zwingli, both of whom relied on governments to put their reforms into place. Neither Luther or Zwingli could imagine a society without a strong leader and, when they removed the pope from authority in their areas, they replaced him with either a local prince or city council. A government-guided church bothered young Zurich dissenters and this eventually led to a clash with the Zurich Council. Some of these dissenters refused to have their infant children baptized because the children were not old enough to understand the meaning of devoting one’s life to Christ. Early in January of 1525 these dissenters met and were re-baptized, signaling their conscious decision to follow Christ (Nolt, 1992). In 1527, they issued a declaration of their beliefs, the Schleitheim Articles, which listed seven articles that
embodied the Swiss Anabaptists' view of a Christian brotherhood living in a viable community (Hostetler, 1993). Such disobedience was not tolerated by the local authorities and the Anabaptists were imprisoned, exiled, tortured, burned, beheaded or sold as galley slaves (Nolt, 1992).

Jakob Ammann, an Anabaptist convert from the Swiss Reform Church, contended that the leadership of the Mennonite church was weakening the life and resolve of the church. He proposed to secure and strengthen the church by: increasing the offering of communion from once to twice a year (because of the required preparation, this was a major change in sect doctrine); to completely shun in all aspects of life those who had been excommunicated; and to deny that those who were not Anabaptists could be saved. The Mennonites, led by Hans Reist, rejected the hard-line stance and, in a strange twist, they and their followers were excommunicated by Ammann. The division did not spread outside of Switzerland and two distinct groups were formed: the larger Mennonite community represented by Hans Reist, and the reforming "Ammann-ish" faction led by Jakob Ammann (Nolt, 1992).

Some twenty years later, Jakob Ammann and his followers tried to bridge the schism that occurred as a result of the excommunication of over half the church in their region. In a symbolic gesture, the Amish leadership excommunicated themselves from the church to demonstrate their repentance and desire to rejoin the larger group of Mennonites. Their
gesture was in vain and met with disdain and ridicule by the Mennonites. While the differences between the two groups continue today, their social relationships have improved (Nolt, 1992). This conflict clearly parallels the conflict put forth by Coser (1956) in his review of Simmel's work.

Coser points out that conflict within a group is often more intense and divisive than that which occurs between groups. Quoting from Simmel, "A hostility must excite consciousness the more deeply and violently, the greater the parties' similarity against the background of which the hostility arises... People who have many common features often do one another worse or 'worser' wrong than do complete strangers" (Coser, 1956, p. 67). Coser notes that Simmel stated that: renegadism is perceived by a close group as a threat to its unity. In other words, the renegade shakes the foundation of the group by threatening its values and interests. The rift within the Anabaptists and the threat that Ammann posed to the Mennonites was so grievous that, even when he and his followers tried to make amends, they were rejected. They were rejected because of the continued threat felt by the Mennonites that they would continue to proselytize if allowed back into the fold. Interestingly enough, it was the Mennonites, and other religions in the "New World", that ended up proselytizing disenfranchised Amish after continuing schisms in the 1960's.
It may be the Anabaptist intolerance of dissension within their groups that has led to the severe schisms that have occurred throughout their history. Nonconformity to church doctrine leads to immediate excommunication and shunning of the guilty individual. In the Mennonite Church, this shunning is strictly in a religious context and social affiliation is still permissible. The excommunication and shunning of the Amish is absolute and complete, even within the family (i.e., a shunned person may not eat with baptized members of the family, sleep with his or her spouse, or engage in any conversation with baptized members). Occasional conflict within a group may serve to remove dissenting elements in the relationships and re-establish unity (Coser, 1956). In the Anabaptist movements, especially the more conservative like the Amish, such conflicts are not tolerated. As a result, conflicts divide the group into two hostile camps. The divisions within the Anabaptist religion are outlined in Figure 2. The groups in Figure 2 are all Anabaptist. However, all those from New Order down are Amish who share five common traits: the use of the German language, style of dress, use of horse and buggy, education to the eighth grade only, and no use of their home for church services (George Kreps, telephone interview by the author, May 18, 1994).

The Amish are preoccupied by perceived threats to their cultural identity (Kraybill, 1989, Hostetler, 1993). This may explain their avoidance of frequent conflictual encounters
which allow their members to express dissatisfaction with the church. As Coser (1956) points out, absence of conflict is not an accurate indication of a stable relationship or society. However, it is hard to argue with 300 years of success. The question remains, how long can the Amish continue to survive as a unique and independent American subculture?

The years of persecution left lasting marks on the Anabaptists. Stories of the persecution suffered by their descendants are still read today. Hymns composed in sixteenth century prisons are still sung during religious ceremonies. The two centuries of persecution suffered by the European Anabaptists still manifests itself in their distrust of governmental authorities. But, group boundaries are established through conflict with the outside (Coser, 1956), so that the Anabaptists were able to define their religion and their moral values as a result of these tragic times. Despite their internal conflicts, this external conflict united the Anabaptist people. They remained loyal to the belief expressed in the Schleitheim Articles throughout the years of persecution and the migration to the Americas. The extent of the conflict may well reflect their strong convictions, by which they continue to live.

Despotism does not necessarily follow in the wake of war, but apparently is dependent on the degree of cohesion of the social system (Coser, 1956). The challenge from the
Figure 2. The Family Tree of the Present Churches in the Holmes County Vicinity which Originate from the Original Amish Congregation (Adapted From: Gingerich, 1981).
outside, as well as the internal conflict in the Anabaptist movement, may be responsible for the reliance on authoritarianism, especially for the Amish in their current cultural make-up. It is unlikely that the historical persecution is solely responsible for the perceived threat by the Amish from outside forces. However, their constant reference back to the period of persecution clearly reflects its continued impact on the group. Continued conflict with the outside world, both through proselytization and outright bigotry against the Amish, reinforces the concerns of the Amish with respect to the non-Amish (English) society.

The "Amish" Identity

When speaking of the Old Order Amish, there are several key characteristics which identify them. Like other religions, the Amish Church teaches regeneration\(^3\). However, their interpretation of the biblical texts is quite different. The Amish understanding of regeneration is Gelassenheit\(^4\). A phrase which is often repeated in Amish and Anabaptist writings is "Wir müssen in Christus still halten" —We must reside quietly in Christ— (Hostetler, 1993). The goal of Gelassenheit is a subdued, humble person who discovers fulfillment in the community (Gemeinshaft\(^5\)). They commit to this

\(^{3}\text{Spiritual or moral revival or rebirth.} \\
^{4}\text{Resignation, staidness, yielding and detachment.}
lifestyle in exchange for a durable and visible ethnic identity which allows them to practice their religion (Kraybill, 1989). However, take away their ecclesiology and religion and the social community disappears (Enninger, 1988).

It is through this tradition that this thesis will explore how the Amish have continued to maintain their identity. Their commitment to conformity with the accepted practices of the group and the symbolic practices they utilize to express this kinship may also be threatening to the Amish communities’ health and well-being.

**Individuality**

To be Amish is to deny the idea of self and to submit to the higher authority. However, does that mean that the Amish do not have individual identities? This is an interesting and important question in the sociology of the Amish culture. The Amish community is a primary social group which involves the individual in a total network of primary and secondary relationships. The Amish are not an abstract organization, but a fully perceptible and, therefore, concrete, face-to-face group in which everybody knows everybody else (Enninger, 1988).

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5 Usually translated as "community", Gemeinschaft refers to relationships that are spontaneous and affective, tend to be related to a person's overall social status, are repeated or long enduring, and occur in a context involving cultural homogeneity. Characteristically, these are the relationships within families and within simpler, small-scale, and premodern societies, including peasant societies (Jary and Jary, 1991).
1988). Perhaps a further exploration of the meaning of individuality should be pursued.

There are two specific meanings of individuality. First, individuality is the sense of freedom and responsibility for oneself that comes from a broad and fluid social environment. The other meaning is that a single human being distinguishes her/himself from all others and that being different provides meaning and value to life (Simmel, 1971). Clearly, the latter definition is what the Amish see as “worldly” and avoid at nearly all costs.

It can be argued that the Amish have a particular proclivity for individualization and a tendency toward nondifferentiation which was discussed by Simmel (1971) through the first definition outlined above. They experience this dualistic drive both in internal and external relationships. The Amish are individuals within a social circle with close but tangible separation from others within their community. They have autonomous family units, enterprises and financial holdings. Yet, they also express a strong devotion to the community with shared labor in construction of homes and barns, and in the harvesting and planting needs of neighbors. However, this community loyalty is not exclusively within their own Amish community as they will come to the aid of the non-Amish.
As discussed earlier, the Anabaptists believe in adult baptism. Their compliance with the *Ordnung*\(^6\) is not a requirement until they have sworn allegiance to the church and been baptized into the church. This usually occurs when they are in their late teens or early twenties (Kraybill, 1989, Hostetler, 1993). They are, by choosing to join the church, making an individual free choice to adopt the Amish life-style. The Amish do not shun individuals who never join the church so the decision is not made under duress. That is not to say that there is not social and family pressure to do so.

The Amish devote themselves to the family and they usually have very large families. The family is an extension of one's own personality. It constitutes a complex within which the individual distinguishes her/himself from all others and in which they develop a selfhood and an antithesis (Simmel, 1971). Even within the overall structure of the Amish community we can see individualism manifesting itself. Amish Church districts are rarely comprised of more than 30 to 35 families.

From this perspective it seems logical to view the Amish not as individuals, but as a society which expresses the sum of its interrelationships with the individuals' position in respect to one another. We can then look at the conception of

\(^6\)Generally unwritten rules by which the Amish govern their lives. The *Ordnung* varies between church district, though variation is limited.
social life by studying the communications network of the Amish (Mayhew, 1980). This communication system is remarkably non-verbal in nature.

**Separation**

The Amish use the family and church districts to express their individuality and their "self". However, they use an entirely different perspective to separate themselves from the outside world. In this context, 'outside world' means anything non-Amish, even non-Old Order Amish. The Amish clearly use a structuralist perspective in order to accomplish and maintain a unique identity and distance from all others. This is driven by their religious conviction and absolute separation from all other religious loyalties.

The Amish are an egalitarian religious sect which offers protection and security for those with similar beliefs. Sectarians put their faith first by ordering their lives and remaining loyal to their beliefs. They are pervasively religious in that they practice their beliefs in everyday life. In contrast to churches which are conservative, orthodox and have a high degree of organization and institutionalization, sects are perfectionist, radical and have a low degree of organization. Sects are perhaps best characterized by their rejection of orthodox religions, doctrines and practices (Troeltsch, 1931). British sociologist Bryan Wilson (1970) observed that sects are self-conscious attempts by people to construct their own societies, not merely as political
entities with constitutions, but as groups with a firm set of values and more, of which they are conscious. This is often considered odd and alien by outsiders, so it is logical that the Amish, like other sects, would establish a structure which would protect their beliefs and values.

A sect must establish cultural separatism by invoking symbolic, material and ideological differences from those outside of their group. Amish faith emphasizes the dichotomy between a community of believers and a profane world of sinners (Hostetler, 1993, Donnermeyer et al., 1993). There are two biblical passages utilized by the Amish to justify this need for separation. First is St. Paul’s Epistle to the Romans (12:2): “Be not conformed to this world, but be ye transformed by the renewing and perfect will of God.” The other passage is St. Paul’s Epistle to the Corinthians (6:14): “Be ye not unequally yoked together with unbelievers; for what fellowship hath righteousness with unrighteousness? What communion hath light with darkness?” (Donnermeyer et al., 1993). The Ammann group symbolism took the form of different styles of dress, grooming and physical appearance (Hostetler, 1993). As time progressed, especially with major advances in technology, there has been an expansion of these symbols of separation utilized by the Amish community.

Symbolic interactionism means different things in different schools of sociological thought. Traditional symbolic interactionism is represented by Blumer; other variations or
interpretations include Kuhn’s more ‘scientific’ approach, Goffman’s dramaturgical approach, and two separate orientations of ethnomethodology and phenomenology (Ritzer, 1988). Kuhn’s view of structural symbolic interactionism may shed some light on this review of the Amish society and is discussed in greater detail later. However, a brief discussion of Amish symbolism would be appropriate first.

**Symbolism**

The Amish reject the use of many religious symbols, such as a house of worship and the crucifix (Kraybill, 1989, Hostetler, 1993), yet they readily embrace symbolism to express to other Amish and non-Amish that “I am Amish.” They use many of the same cultural objects that other Americans utilize. As Kraybill (1989) points out, “They read newspapers, throw baseballs, and barbecue hamburgers on gas grills.” The Amish are much like other Americans, but there are major differences which separate and set them apart as a unique American sub-culture. Their style of dress, use of language, mode of transportation, agricultural practices, architectural design and domestic environment announce the ethnic affiliation of the Amish. The windmills, buggies, lanterns and bonnets are artifacts which serve both symbolic and substantive functions in Amish culture (Kraybill, 1989).

Every Amish person knows the accepted way of doing things and uses actions rather than words as normal courtesy. In the Amish society where convention is understood, few
words are needed to be precisely understood. Within their society, symbolism is an effective means of social control (Hostetler, 1993). There is some differentiation in dress between Amish settlements and church districts, but there are universal traits consistent throughout the culture (Kraybill, 1989). These include the use of hook and eye as opposed to buttons on the Sunday coat and vests of all men; trousers that have no fly-closing but a flap that buttons along the waist, with no external pockets; wide-brimmed, black felt hats for men; suspenders instead of a belt; white organdy caps and uncut hair for women; long hair with bangs for men; and certain farming practices. These symbols constitute a social reality that teaches those in the Amish community how to conform (Hostetler, 1993).

Since the beginning of the twentieth century, the Amish have developed more symbolic expression to separate themselves from the non-Amish society. This increased use of symbolism began as modernization took hold throughout America as innovations that were developed during the industrial revolution were adopted. The 'breach of 1910' was a dispute over the old conflict of shunning. However, those that broke with the Old Order began to utilize some of the new innovations like telephone, electricity and automobiles. The Old Order banned the further use of these innovations by their members to further divorce themselves from the renegades (Kraybill, 1989). As the rest of society continued to modernize, the
rejection of these innovations became more pronounced symbols of separation for the Amish and offered further protection for their communities, values and ways of life.

Casual observers are often critical of the Amish because of their selective use of these "prohibited" worldly conveniences. The Amish do in fact use telephones, ride in automobiles, and use electricity in shops and places of employment. Yet they make a clear distinction of the use of any of these innovations in ways which may threaten their community structure. They have actually evolved the prohibition of these "worldly" items into a functional way of keeping their community and church together. The functionality of these artifacts are used by the Amish as symbols of who they are. Functional explanations have their clearest application in connection with artifacts and artificial systems (Little, 1991), such as the contrived folk society (Olsham, 1981) developed by the Amish. However, this leaves open the possibility that they would change certain cultural practices which are proved to be detrimental, providing these changes were not perceived as threatening to their commitment to separation, Gemeinschaft or Gelassenheit.

Symbolic Interactionism and the Amish

According to Clyde Franklin (1982), George Herbert Mead’s position separating humans from other species poses the human self as reflexive. By reflexive he meant that the individual can become an object unto her/himself. This is
accomplished through adopting the position of others and viewing oneself from the standpoint of others. Though the Amish deny the importance of the self, they can experience shared meanings of the gestures projected by themselves and others. Franklin also points out that according to Bernard Meltzer’s interpretation of Mead’s work, when an individual or a group of individuals incorporates observed behavior into their own it becomes social. “Society, then, according to Mead and interpretations of his work appears to be symbolic interaction in process.”

The Amish not only utilize symbolism, they have incorporated it into their entire way of living. If symbolic interactionism emphasizes the constraining and/or setting influence of social structure on social interaction (Franklin, 1982), then clearly structural symbolic interactionism applies to the Amish society. The roles that the Amish assume in their everyday life arise from and are sustained by the reward value of adjustment and adaptation to social structures (Turner, 1993, Mead, 1934). The reward the Amish experience is continued membership in a community which allows them to practice their religion. The adaptations that they make are to remain in conformity with the Ordnung or unspoken rules of their church district. Social change does occur in the Amish community, but it does so at a very slow pace and then only if not perceived as a threat to the community
structure by the Bishop of a given church district or Bishops within a given settlement (Kraybill, 1989, Hostetler, 1993).

Manford Kuhn has been called the chief architect of structural symbolic interactionism (Franklin, 1982). However, in relation to other symbolic interactionists he has also been called the “Odd man out” (Denzin, 1992). That debate is best left for others to argue, however, Kuhn’s definition of self is an appropriate reflection on the Amish view of the self. Kuhn defines the self in structural terms and sees the self as a structure of attitudes derived from the individuals’ internalized status and roles. To Kuhn, the individuals’ conception of themselves are derived from others and the roles and status they assume (Franklin, 1982). To the Amish their shared values, roles and status define who they are. As a result, others in the community are expected to behave toward the self-defined consensual person in a similar manner and in every aspect of daily life.

The Amish society is a complex social structure. At first, it appears to be a markedly homogeneous society, and in many aspects there is a high degree of similarity. However, their decentralized system of autonomous family units and church districts allows for the development of “generalized others”7 within the Amish community itself. As a

7The general concept of “other social actors” that individuals abstract from the common elements they find in the attitudes and actions of others (Jary and Jary 1991).
subculture or subgroup of the larger American society, they also play the role of "generalized other" within this larger context as well. The Amish use of symbolic interactionism allows them to function as a unique social structure.

In relation to the questions being investigating in this thesis, it is necessary to look at the agricultural practices which lead to the respiratory concerns expressed earlier. The Amish seek to maintain the community structure by maximizing primary relationships. The small farming community is the most promising setting within which to carry out the ultimate goals of life (Hostetler, 1993). The effort to remain small and to avoid the outside influence which would threaten their community structure are the primary motivations for their symbolic expression.

The introduction of the tractor into agriculture between 1910 and 1930 revolutionized agriculture in the United States. Between 1924 and 1960, the tractor completely replaced draft animals (Williams, 1987) outside of the Amish community. This and other mechanized agricultural equipment such as the combine, came to symbolize to the Amish the loss of the small farming community and was considered to be a threat to their way of life. Other technological innovations such as hybridized seed and pesticides, have also been attributed to increasing the size of agricultural operations (Kenney et al., 1991). However, these innovations have not been viewed as threatening by the Amish who readily use both
agricultural chemicals and hybrid seed (Dean Slates, Terry Beck and Larry Ault, Ohio State University Extension, interviewed by the author, February 1993). The effect of industrialized agriculture has been well documented by Goldschmidt (1978) and others (Lobao and Thomas, 1988) and, overall, supports the Amish concern about largescale farming.

Rejection of the tractor not only symbolizes the Amish culture, but it also serves the practical purpose of limiting the size of a farm any one individual can manage. In the corn belt, one man with modern machinery and a limited number of hired help can operate a 600-acre farm with little or no livestock. In contrast, the Amish farmer manages an average of about 85 acres and must rely on livestock production and family labor to maintain economic viability (Hostetler, 1993, Kraybill, 1989). While the use of draft animals, versus tractors and other farm machinery, has advantages (reduced soil compaction, less reliance on fossil fuel, etc.), it does potentially expose the Amish farmer to higher levels of non-organic and organic dusts and mold.

The Amish rejection of utility-supplied electrical power is an additional factor that increases the potential jeopardy to their respiratory health. Without electrical power, the Amish are unable to utilize active ventilation systems in their barns and livestock facilities. While they may use a stationary tractor to load silage into silos, they are unable to use electrical silo unloaders. Thus, they are required to
hand pitch the silage. Therefore, the Amish farmer is required to spend longer periods of time, more frequently and in closer proximity to known causative agents of hypersensitivity pneumonitis (HP) and Organic Dust Toxicity Syndrome (ODTS).

If the symbolism used by the Amish to separate themselves from the non-Amish places them in jeopardy, could it also be utilized to remove or reduce that peril? In other words, it may be possible to alter the symbolism used in certain farming practices if compelling evidence could be brought forward to convince the Amish that their health was in jeopardy as a result of these practices. Furthermore, the internal conflict to conform to the will of the whole would accelerate adoption of farming practices or the use of personal protective equipment (PPE).

It is beyond the scope of this thesis to explore the adoption of interventions. Rather, it is to establish the premise that such conditions exist. This will create an avenue for further work in the introduction and establishment of mitigating practices to alleviate the potential for respiratory harm. The primary hypothesis states that Amish farmers will suffer a higher prevalence of reduced lung function, possibly hypersensitivity pneumonitis or Farmer's Lung, compared to non-farming Amish, and farming and non-farming non-Amish. This theory may, to a lesser extent, explain the prevalence of HP and/or ODTs in other occupations of the
Amish (wood mills, carpentry, etc.), which may also result in reduced lung function because of the high levels of wood dust. Furthermore, and perhaps most importantly, this theory would offer promise that the Amish would modify their practices in mass if overwhelming evidence and suitable alternatives were presented.

Hamman (1981) found that the Amish mortality rates from respiratory problems were 80% lower in males 40-69 and 50% lower in males in the 70+ age group when compared to their non-Amish neighbors. Low mortality from respiratory conditions does not preclude the potential for high incidence of sub-acute problems. The Amish do not practice preventive medicine (Hostetler, 1993) and may not recognize a correlation between a persistent cough or other maladies associated with hypersensitivity pneumonitis and their farming practices.

The Amish refuse to accept or pay for life or health insurance (Adams, 1986), and this most definitely affects the type of medical services they utilize. The Amish successfully lobbied for an exemption from the Social Security system's tax and the potential benefits from its medical care, disability and retirement plans (Hostetler, 1993, Wiggins, 1983, Kraybill, 1989). Citing the biblical passage (I Timothy 5:8) "...if any provide not...for those of his own house, he hath denied the faith, and is worse than an infidel," the Amish argued that to admit that the government has a responsibility
for the sick and aged Amish members is a denial of their faith (Hostetler, 1993).

The Amish have a long tradition of coming to the aid of church members and neighbors in times of need. In the late 1960's, they established a more formal system of aid, known as the Amish Church Aid, to ensure that sufficient funds would be available in case of an emergency. The development of this self-insurance program was a result of a concern by Amish leaders that commercial insurance would undercut the community's reliance on spontaneous mutual aid (Kraybill, 1989). The Amish who join the Amish Church Aid pay an initial fee and then are assessed for additional payments as the need arises. Families are expected to pay a "deductible" of $1,000 per family, but additional expenses are reimbursed by the fund. Participation in the Amish Church Aid varies by community or church district. Many Amish view the fund as too similar to commercial insurance programs.

While there are many Amish participating in the mutual aid program, they continue to practice spontaneous aid, coming to the assistance of church members in the time of need. Once an individual's illness is acknowledged, community support for the person and their family is apparent. Concern for the sick constitutes a subject of major interest in every Amish community. Church members visit the sick person regularly and The Budget newspaper will report on their condition, progress and the type of treatment they are receiving.
Those who cannot visit will send cards, letters and often money to help the person and the family in need (Hostetler, 1976; Wiggins, 1983).

The Amish often hesitate to see a doctor unless their condition is serious (Dr. Lehman, interview by the author, Mt. Eaton, Ohio, December 1992). Both Hostetler (1981) and Kraybill (1989) confirmed this reluctance to call the doctor. They imply this is a result of the lack of sophisticated knowledge and familiarity with disease. However, Dean Slates, Extension Agent, Holmes County, who has worked extensively with the Amish over the past few years, holds a different viewpoint (Interviewed by the Author, Wocster, OH, February, 1993). He believes that this reluctance has more to do with the cost than lack of education or understanding. He does not necessarily disagree with Hostetler and Kraybill, but places greater emphasis on the cost factor. His conclusions may be conjecture; however, Wiggins (1983) supports this hypothesis and discusses this as a "...potentially increasing problem separating the Amish from scientific medicine." According to Wiggins, Amish leaders see rising medical costs as one of the more serious problems to be faced in the future.

Wiggins (1983) reports that an unpublished doctoral dissertation (J.A. Egeland, Yale 1967) found that an Amish person’s choice of healer or professional is based on intense family or kinship loyalty to one or the other. This loyalty, according to Wiggins, transcended other considerations or
variables, such as costs of treatment, distance to the care
giver, and the healer’s reputation. The primary forces influ-
encing the Amish choice of health care are unclear, though
the cost of treatment apparently does influence their deci-
sion, along with loyalty, severity and logistics.

Amish expect to pay for the medical services that they
receive (Wiggins, 1983, Heikes, 1985). They generally feel
that the so-called free services are being paid through in-
flated fees from other services (Heikes, 1985). In addition,
the Amish view the acceptance of these services as making
them indebted and dependent on the health care provider. They
would rather regard the hiring of all medical service as a
purely business proposition (Wiggins, 1983).

This introduction has explained the fundamental concepts
of the Amish society using various sociological theories. It
has also endeavored to demonstrate how the lifestyle may in-
fluence their potential for exposure to the causative agents
for Farmer’s Lung and TOSD. This discussion was intended to
establish the unique aspect of the Amish subculture and to
evaluate how their cultural practices increase their risk of
these diseases. Finally, if this theoretical perspective of
the Amish is correct, it will support the concept that it is
possible to collectively initiate a change in their behavior
and cultural practices.
Chapter IV

Materials and Methods

Whenever it is deemed necessary for the Amish to seek medical treatment, they are not generally averse to utilizing modern medical technology. There have even been examples of the bishops granting exemptions for generator-supplied electrical power to operate medical devices needed to treat an ailing family member. Therefore, it was determined that setting up testing facilities in a central gathering place of the Amish and having them perform lung function tests, using computerized spirometers, would be possible. This testing, along with a detailed history of lung disorders and exposure to the causative agents of Farmer's Lung, can serve as an effective survey method to determine the necessity of further testing which can diagnosis the condition.

Screening the Amish population to determine the extent of these problems may be possible if it is done carefully and is not viewed by the Amish as intrusive. A completely random selection of individuals from within the population would undoubtedly be deemed intrusive unless overwhelming evidence could be presented to the Amish bishops regarding its need. Advanced word and explanation of the study were presented to Amish community leaders through County Extension Agents in
Wayne and Holmes Counties. The reaction of these individuals confirmed the improbability of collecting a truly random selection. The leaders were interested and not opposed to the study for any individual who wished to participate. However, they were unwilling to endorse the study, which would be a prerequisite for true random selection given the edict of the Amish to maintain separation from the outside world.

Physicians in the Wayne and Holmes County area indicate that they do not notice apparent elevated levels of respiratory problems in the Amish as compared to the rest of the local population. There is agreement among these physicians that the behavioral tendencies of the Amish would preclude them from seeking treatment until the condition became serious (Dr. Nashawati, telephone interview by the author, January 1993, Dr. Lehman, interview by the author, Mt. Eaton, Ohio, December 1992). Considerable thought and discussion with Extension agents, physicians and Amish contacts proceeded other discussion of when and how to collect the data. Several suggestions were explored which would allow exposure to large numbers of Amish who might be willing to participate in the study. Access to the Amish in their homes was deemed impractical, if not impossible, without substantial evidence that a serious health problem existed in the Amish community. Two options for testing and questioning the Amish were considered viable. The first was to set up the survey at livestock auctions held weekly at three locations in the
Holmes County area and at least one test site at a special auction (which would include both farming and non-farming Amish). The second option which emerged was to set up at blood drives conducted by the American Red Cross in various locations throughout the Wayne and Holmes County areas.

It was determined that the second option offered the best opportunity to successfully conduct this study. First, both farming and non-farming Amish were likely to attend the blood drives. Second, those donating blood would be more likely to participate in an additional clinical procedure than those attending a livestock auction and who were there primarily to buy and/or sell livestock. Third, conditions would be more favorable to set up the spirometry testing stations in the areas used by the blood drives. Fourth, greater privacy could be afforded to those willing to participate in the lung function test at the blood drive sites than at crowded livestock auctions.

The individuals that participate at these blood drives are a self-selecting sample and not a true representation of the Amish population. It could be argued that only the most healthy of individuals would be willing to come to the blood drives to offer blood. This would be a logical conclusion and may have biased the sample. However, it is important to note that not all of the people who came to the blood drive were accepted for blood for a variety of reasons, including illness, anemia, low blood pressure or other reasons. The
survey and lung function testing of interested individuals occurred prior to their beginning the eligibility process for the donation of blood. As a result, there was no selection of only individuals healthy enough to give blood. Therefore, participants in this study are a subset of individuals who consider themselves healthy enough to donate blood.

Several methods were employed to advise the community about the test and their locations and times. Community leaders were informed of the testing through the Amish advisory committees in both Wayne and Holmes Counties. Several local physicians who work extensively with the Amish were informed of the test and the test locations. Articles written in layman’s terminology about Farmer’s Lung and TODS were published in local editions of The Budget and The Bargain Hunter, popular publications in the Anabaptist communities. The articles appeared one to two weeks before the actual lung function testing was conducted, and information about the locations of the test sites were included in the articles.

The National Institute for Occupational Safety and Health, Division of Respiratory Disease Studies (NIOSH-DRDS) provided computerized volumetric spirometers for the lung function tests. Dee Jepsen and the author were trained at a three-day workshop at the Morgantown, WV, NIOSH-DRDS facility. This training combined lecture and hands-on training in both theory and application of the spirometry technique. Upon completion of the training program and passage of a
comprehensive test, these individuals were awarded certification as qualified technicians in the use of the NIOSH spirometers and in conducting the testing procedures. A third technician assisted in the testing, Ms. Nan Migliozzi, who is a registered occupational health nurse and a part-time instructor at the Ohio State University (including the instruction of spirometric techniques). A registered nurse, either with the lung testing program, or with the American Red Cross was available at all times in the unlikely event of a medical emergency with any of the participants in the study.

The tests were conducted in conjunction with American Red Cross Heartland District Blood Service blood drives in Wayne and Holmes Counties of Ohio in June of 1993. Specific dates and locations were: Berlin on June 17th, Walnut Creek on June 18th, Fryberg on June 22nd, and Fredericksburg on June 23rd.

Only persons over the age of 18 were eligible to participate in the testing. In addition all individuals were asked their age. All women were asked if they were pregnant (none were identified). This was because of similar limitations placed by the American Red Cross for blood donors.

As they entered the facility, individuals were asked if they would be interested in participating in the lung function study. At first, an attempt was made to ask only every third person if they would participate in the study. However,
this soon proved problematic as individuals often arrived in bus (minivan) loads and the questioners were unable to isolate specific individuals. Often when they arrived with a group, either all or none would participate. Furthermore, many who initially declined to participate changed their minds after seeing and talking with others who did perform the test. Results were coded to indicate whether these individuals performed the test after giving blood.

Coupons for free ice cream were offered as tokens of appreciation to participants in the study. It could also be argued that this may have influenced some individuals to participate in the study. However, this was not observed during the tests, and many people openly thanked us for conducting the test. All seemed genuinely interested in the results of the test and the health of their lungs. Furthermore, only 37.5% of the free ice cream coupons were redeemed in the two-week period during which they were valid.

All participants signed a consent form\(^8\) and answered a series of demographic and health related questions. The questionnaire\(^9\) used for this pre-test survey was adapted from a proven instrument developed by the Marshfield Medical Research Foundation at the University of Iowa (Rylander, 1990). Five of six questioners were trained the week before the tests were actually conducted. Each of them went through

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\(^8\)See Appendix A.

\(^9\)See Appendix B.
both of the questionnaires by asking each other questions. The sixth questioner, a registered nurse with the Wayne County Department of Health who was experienced in occupational respiratory problems, was mailed the questionnaire in advance. On the morning of the test day when she was questioning the participants, she was briefed on the questionnaire and all of her questions were answered before she began to ask any questions.

The questions included information on the subjects’ past behavioral or occupational practices which might place them at higher risk of experiencing respiratory problems and give plausible alternative explanations for abnormal lung function results. They were also asked a series of questions concerning their history of respiratory problems. For the purpose of identification of selected groups, they were also asked to which church they belonged. Questioners were directed to ask specifically if they were Old or New Order Amish.

Spirometry is a standard clinical non-intrusive medical screening procedure that measures various aspects of breathing and lung function. In this test a volume spirometer, which measures the amount of air exhaled within a certain time frame, was utilized. Each participant was asked to breath in as much air as possible. They were instructed to exhale as hard as they could as soon as their lungs were full and to continue to blow out as long as they could (at least six seconds). It was necessary to conduct at least five tests
per individual; however, no subject was asked to perform more than eight attempts.

Three measurements obtained through spirometry are particularly useful: Forced Vital Capacity (FVC)$^{10}$, Forced Expiratory Volume at one second (FEV$_1$)$^{11}$, and the ratio of the FEV$_1$ to the FVC$^{12}$ (NIOSH, 1992). While other measurements were recorded, these three were the only ones analyzed and considered in this study. Interpretation of these data provides information on the lung function of an individual relative to other individuals of the same sex, age and height. Table 1 provides an overview of interpretation that can be derived from spirometry data.

**Table 1. Interpretation of Lung Function Results.**

<table>
<thead>
<tr>
<th>Interpretation</th>
<th>FVC</th>
<th>FEV$_1$</th>
<th>FEV$_1$/FVC%</th>
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<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Airway Obstruction</td>
<td>Low or Low Normal</td>
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<td>Low</td>
</tr>
<tr>
<td>Lung Restriction</td>
<td>Low</td>
<td>Low or Low Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Obstruction &amp; Restriction</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

$^{10}$The maximal volume of air which can be exhaled forcefully after maximal inspiration.

$^{11}$The volume of air exhaled during the first second of a forced expiratory maneuver.

$^{12}$Forced expiratory volume in one second expressed as a percent of the forced vital capacity.
Results of this test clearly depend on the subject’s ability to understand the maneuver, to completely fill their lungs prior to beginning the exhalation, to sustain a maximal effort during the exhalation, and to continue the effort until the lungs are completely emptied (Boehlecke, 1986). Therefore, qualified technicians assisted in the administration of the test to the participants. Three maneuvers with values for FEV within 5% of each other are required for a valid test. Additional maneuvers add little information and do not significantly reduce the variability of results for the session (Boehlecke, 1986). To ensure that at least three good curves were obtained, each participant was asked to perform the test at least five times\textsuperscript{13}.

Results were analyzed by NIOSH-DRDS in Morgantown, West Virginia, and summaries of the results were sent directly to the Ohio State University. For any given age and height, there is a range of value for forced vital capacity or forced expiratory volume (in one second). The lower limit of “normal” is defined as that value above which 95% of healthy individuals in a population would fall. This is approximately the mean value minus 1.64 standard errors of estimate. From the magnitude of the standard error of FEV, it can be shown that any value below approximately 80% of the mean predicted value will be considered “abnormal” (Boehlecke, 1986). In this

\textsuperscript{13} Appendix C contains examples of test results from two participants. One within the normal range (Figure 3) and one below the normal range (Figure 4).
study, NIOSH standards are followed and both percentage of predicted values and the lower limit of the normal range (LLN) are used to determine if the subject falls within what would be considered a normal range for lung function (NIOSH, 1992).
Chapter V

Results

Over the four-day period, 133 individuals participated in the lung function test. NIOSH considered 127 of the 133 tests results, or 95%, to be valid with at least three reproducible trials. The breakdown of the acceptable curves based on church affiliation was: 62 Old Order Amish, 28 New Order Amish, 11 Mennonite, and 26 non-Anabaptists. For analysis of the data, Mennonites have been included with the non-Anabaptist group due to the small sample size\textsuperscript{14}.

Results from the spirometry tests showed that there were five individuals with mild obstructions and two individuals with mild restrictions. The two individuals with mild restriction were Old Order Amish, one was a farmwife and the other a housewife. All the individuals with mild obstructions were from the general population, with the exception of one Old Order Amish carpenter. Dividing the individuals into groups by church and occupation (see Table 2) demonstrates

\textsuperscript{14}One individual (test subject C-50), a non-Amish farm-hand, was waiting for us when we arrived at the Fredricksburg testing facility. He had read about the testing in a local newspaper and had come specifically to be tested. His lung function was below the expected normal range. He is the only individual that we know of who came specifically to be tested. Therefore, we shall refer to the test results with and without C-50 throughout this discussion of the results.
that all groups averaged well into the normal range for lung function.

The methods utilized in the analysis of the data collected are: One-way analysis of variance for comparison of FEV1/FVC between church affiliation; Correlation analysis for association between various answers to questions asked prior to the spirometry testing and the relationship between the answers to pretest questions and the test results; Chi-Square analysis for association between the answers to test questions and church affiliation.

In comparing the groups, there was a significant difference (p=.002) between the Non-Amish and the New Order Amish test subjects (Table 2). Table 3 shows that difference

Table 2. Analysis of Variance on FEV1/FVC with Subject C50.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Church</td>
<td>2</td>
<td>422.8</td>
<td>211.4</td>
<td>6.50</td>
<td>0.002</td>
</tr>
<tr>
<td>ERROR</td>
<td>124</td>
<td>4034.6</td>
<td>32.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>126</td>
<td>4457.4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INDIVIDUAL 95 PCT CI'S FOR MEAN BASED ON POOLED STDEV

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>N</th>
<th>MEAN</th>
<th>STDEV</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Order</td>
<td>63</td>
<td>96.46</td>
<td>5.31</td>
<td>(-----*-----)</td>
<td>(------*------)</td>
</tr>
<tr>
<td>New Order</td>
<td>27</td>
<td>98.61</td>
<td>5.52</td>
<td>(------*------)</td>
<td>(------*------)</td>
</tr>
<tr>
<td>Non-Amish</td>
<td>37</td>
<td>93.53</td>
<td>6.44</td>
<td>(------*------)</td>
<td>(------*------)</td>
</tr>
<tr>
<td>POOLED STDEV</td>
<td></td>
<td>5.70</td>
<td></td>
<td>92.5</td>
<td>95.0</td>
</tr>
</tbody>
</table>

POOLED STDEV = 5.70

held true even without test subject C-50 (p=.005). NIOSH (1992) considers any test result within the normal range (above 85% of the expect result for an individual of the same sex, age and height) as healthy individuals.
Table 3. Analysis of Variance on FEV₁/FVC w/o Subject C50.

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Church</td>
<td>2</td>
<td>355.4</td>
<td>177.7</td>
<td>5.64</td>
<td>0.005</td>
</tr>
<tr>
<td>ERROR</td>
<td>123</td>
<td>3873.3</td>
<td>31.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>125</td>
<td>4228.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INDIVIDUAL 95 PCT CI’S FOR MEAN
BASED ON POOLED STDEV

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>N</th>
<th>MEAN</th>
<th>STDEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Order</td>
<td>63</td>
<td>96.46</td>
<td>5.31</td>
</tr>
<tr>
<td>Old Order</td>
<td>27</td>
<td>98.61</td>
<td>5.52</td>
</tr>
<tr>
<td>Non-Amish</td>
<td>36</td>
<td>93.88</td>
<td>6.17</td>
</tr>
</tbody>
</table>

POOLED STDEV = 5.61

It is interesting that there was a significant difference among the test results of the general population and the New Order Amish, who rarely even start smoking and do not smoke once they have been baptized into the church. These data indicate that overall, long-term chronic effects from Farmer’s Lung disease do not appear to be a problem with any of the groups tested. Table 4 shows that this holds true despite the occupation or religious affiliation of the test subjects.

Symptoms of TODS include flu-like symptoms and shortness of breath and occur for only short periods of time. Therefore, detection of TODS using the spirometric screening procedure employed in this study would be highly unlikely. The specific questions asked in the pretest interview may suggest the possibility of whether the participants have
experienced this condition at any time. The questions asked specifically to the participants who listed their occupation

Table 4. Average Percentage of Lung Function Test.

<table>
<thead>
<tr>
<th></th>
<th>Average Percentage of Predicted Values for Lung Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Order Farmers</td>
<td>96.62%</td>
</tr>
<tr>
<td>Old Order Wood Workers</td>
<td>96.08%</td>
</tr>
<tr>
<td>Old Order Other Occupations</td>
<td>97.36%</td>
</tr>
<tr>
<td>New Order Farmers</td>
<td>97.28%</td>
</tr>
<tr>
<td>New Order Wood Workers</td>
<td>97.82%</td>
</tr>
<tr>
<td>New Order Other Occupations</td>
<td>99.82%</td>
</tr>
<tr>
<td>Non-Amish Farmers</td>
<td>91.66%</td>
</tr>
<tr>
<td>Non-Amish Wood Workers</td>
<td>95.13%</td>
</tr>
<tr>
<td>Non-Amish Other Occupations</td>
<td>93.68%</td>
</tr>
</tbody>
</table>

as farming\(^{15}\) inquired if they had experienced a cough, sick feeling or shortness of breath after working in a barn, silo or dusty environment (e.g., during harvest) on the farm.

The overall general respiratory health of the participants may be attributed to the low incidence of smoking (See Table 5). Overall the amount of long-term or habitual smoking among all of the participants was low. The low percentage of New Order Amish who smoked at one time and the complete lack of those who were currently smoking in this group may account for the low incidence of farmers reporting symptoms

\(^{15}\)See Appendix B
consistent with TODS noted above. The slightly higher percentage of non-farming non-Amish with lower average values of predicted spirometric readings may be a result of a higher percentage of smokers. The analysis of smoking between the groups is discussed in greater detail below.

Table 5. Smoking Habits of Test Participants

<table>
<thead>
<tr>
<th></th>
<th>Currently Smoke</th>
<th>Have Smoked</th>
<th>Never Smoked</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Order Farmer</td>
<td>5.0%</td>
<td>50.0%</td>
<td>45.0%</td>
<td>20</td>
</tr>
<tr>
<td>Old Order Wood Workers</td>
<td>18.2%</td>
<td>50.0%</td>
<td>31.8%</td>
<td>22</td>
</tr>
<tr>
<td>Old Order Other Occupations</td>
<td>4.2%</td>
<td>50.0%</td>
<td>45.8%</td>
<td>24</td>
</tr>
<tr>
<td>New Order Farmers</td>
<td>0.0%</td>
<td>20.0%</td>
<td>80.0%</td>
<td>15</td>
</tr>
<tr>
<td>New Order Wood Workers</td>
<td>0.0%</td>
<td>33.3%</td>
<td>66.7%</td>
<td>6</td>
</tr>
<tr>
<td>New Order Other Occupations</td>
<td>0.0%</td>
<td>11.1%</td>
<td>88.9%</td>
<td>9</td>
</tr>
<tr>
<td>Non-Amish Farmers</td>
<td>0.0%</td>
<td>60.0%</td>
<td>40.0%</td>
<td>5</td>
</tr>
<tr>
<td>Non-Amish Wood Workers</td>
<td>33.3%</td>
<td>33.3%</td>
<td>33.3%</td>
<td>3</td>
</tr>
<tr>
<td>Non-Amish Other Occupations</td>
<td>6.9%</td>
<td>48.3%</td>
<td>44.8%</td>
<td>29</td>
</tr>
</tbody>
</table>

If we include test subject C-50 in our correlation analysis, we find the following relationships\(^{16}\). There was a strong correlation (See Table 6) between those reporting coughing regularly in barns and those who reported coughing regularly in silos. There was only a moderate relationship between the barn coughs and those reporting difficulty breathing in the barn, feeling sick when working in a silo

\[^{16}\text{See Appendix D (Table 9)}\]
and feeling sick when harvesting hay. There was a moderate correlation between those who reported feeling sick during or following the harvesting of hay and those who reported smoking at some time in their lives, those reporting regularly coughing in barns and those having difficulty breathing in barns. There was also a moderate relationship between feeling sick during or after work in a silo and silo coughing and difficulty breathing in barns.

Table 6. Measures of Association (Davis, 1971)

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.70 or higher</td>
<td>Very strong association*</td>
</tr>
<tr>
<td>.50 to .69</td>
<td>Substantial association</td>
</tr>
<tr>
<td>.30 to .49</td>
<td>Moderate association</td>
</tr>
<tr>
<td>.10 to .29</td>
<td>Low association</td>
</tr>
<tr>
<td>.01 to .09</td>
<td>Negligible association</td>
</tr>
</tbody>
</table>

*relationship

As indicated earlier, NIOSH (1992) considers any value over 85% of the expected FEV1/FVC to be normal. Interestingly, there was a moderate negative correlation between FEV1/FVC values and those reporting regular coughing in barns and those reporting difficulty breathing in barns. However, these were low when subject C50 was removed from the analysis. A strong association between barn cough and difficulty breathing in barns was maintained with the removal of subject C50. However, virtually every moderate association
reported above dropped to a low association when this subject was not considered in the analysis\textsuperscript{17}.

To further anatomize the situation, correlation analysis within each church group was run\textsuperscript{18}. For the Old Order Amish, there was a moderate correlation between those reporting feeling sick when harvesting hay and those who reported working in what they considered a dusty job. There was a strong association between those reporting a barn cough and those who reported coughing when working in silos.

In the New Order test participants, there was a moderate association between those who reported usually having a cough and those reporting regularly coughing in barns. That same relationship was substantial with those who reported generally coughing 4 to 6 times a day. Furthermore, there was a moderate negative correlation in their FEV1/FVC readings and those who experience coughing in the barn. Interestingly, there was a moderate negative correlation between those who had ever smoked and those who reported usually having a cough. So apparently their earlier indiscretion to try smoking was not overtly affecting their respiratory health. While that finding is not all that surprising, it was noteworthy that there was also a moderate negative

\textsuperscript{17}See Appendix D (Table 10).

\textsuperscript{18}See Appendix D (Table 11).
association between those who reported having worked in a dusty environment and those who had ever farmed.

Non-Amish farmers were too small in number to provide an adequate comparison. However, there was a significant difference between the Old Order and New Order Amish farmers reporting feeling sick during the harvesting of hay. Among the

Table 7. Chi-Square analysis for New Order and Old Order Amish who reported feeling sick during hay harvest.

<table>
<thead>
<tr>
<th>ROWS: HAY SICK</th>
<th>COLUMNS: Church</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Old Order</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>ALL</td>
<td>28</td>
</tr>
</tbody>
</table>

CHI-SQUARE = 6.065 WITH D.F. = 1
CRITICAL(P=.025) 5.024

Old Order, 55% of the farmers reported having experienced these symptoms at least once (primarily while thrashing or handling grain), while only 20% of the New Order farmers reported such symptoms. It is not clear why this difference between the two groups exists. New Order Amish in the area utilize similar harvest and grain handling techniques as the Old Order Amish (Dean Slates, Extension Agent, Holmes County, telephone interview by the author, July 1993 ), and their use of tractors should have no influence on this condition.
The high association between church affiliation and those who ever smoked certainly suggests that smoking may be a factor. Current smokers were independent of church affiliation with very few of the test participants reporting that they now smoke (9 out of 127). There was a strong association between church affiliation and those reporting that they have ever smoked (p=.005). The New Order Amish, as indicated ear-

Table 8. Chi-Square analysis, by church groups, for test participants having ever smoked.

<table>
<thead>
<tr>
<th>ROWS: EVER SOM</th>
<th>COLUMNS: Church</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Old Order</td>
</tr>
<tr>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>1</td>
<td>37</td>
</tr>
<tr>
<td>ALL</td>
<td>63</td>
</tr>
</tbody>
</table>

CHI-SQUARE = 13.293 WITH D.F. = 2
CRITICAL (p=.005) = 10.597

lier, rarely had ever smoked. Furthermore, there was a negative correlation between farmers and those who had ever smoked and New Order farmers\textsuperscript{19}. However, it is not possible to support the supposition that the higher incidence of feeling sick during hay harvest in the Old Order and their smoking habits based on the data presented in this thesis.

\textsuperscript{19}See Appendix D (Table 12)
Chapter VI
Conclusion

The Amish appear to place themselves in environmental situations which make them vulnerable to occupational respiratory disease. However, there is little evidence to support the hypothesis that the Amish have a higher incidence of abnormal respiratory function than other populations. Hypersensitivity pneumonitis is a hyperallergenic disorder to which only a small percentage of the population is susceptible given the right environmental conditions. No evidence was found that the Amish are suffering from an increased incidence of this abnormality. To adequately analyze the situation, a larger completely randomized sample of Amish farmers would be necessary. It is unlikely that this would be feasible unless overwhelming evidence would be presented to the Amish community.

There is some indication, based on the positive answers to the pretest questions regarding coughing and difficulty breathing, that the Amish do experience high levels of Toxic Organic Dust Syndrome among their farming population. This seems to be true primarily during periods when they are thrashing barley, wheat or oats. However, this situation may be aggravated by the number of individuals in the Amish
population who smoked for at least some period of time. The strong correlation between silo and barn coughing in the Old Order Amish certainly suggests that the use of personal protective equipment, such as paper filter face masks, should be encouraged. The negative correlation between the New Order farmers' PEV1/FVC readings and coughing in barns suggests that increased use of personal protective equipment should be encouraged in this population as well.

Unfortunately, none of the farming participants were asked if they use personal protective equipment (PPE). Therefore, it is not possible to adequately evaluate the extent this innovation is in current use in the Amish community. Amish farmers are familiar with some PPE through pesticide training programs, which they must complete before purchasing certain types of agricultural chemicals. Some individuals have been observed wearing the paper face mask type of respiratory protection while working in dusty environments. A major supplier of PPE in the area confirms that many individuals with Amish surnames in the Wayne and Holmes County area do purchase PPE (Steve Schlecht, interviewed by the author, February 10, 1994). However, it is not apparent that the use of this equipment or any other type of PPE is pervasively used by the Amish. Future health and safety research should include this type of data in the questioning of this population.
Overall, the data show that both the Old and New Order Amish, as well as the non-Amish population of Wayne and Holmes Counties, appear to have normal respiratory health. While some concerns have been raised, the general prognosis is favorable. Thus, the hypothesis that Amish farmers will suffer a higher prevalence of reduced lung function, possibly hypersensitivity pneumonitis or Farmer's Lung, compared to non-farming Amish, and farming and non-farming non-Amish must be rejected. The alternative hypothesis that the Amish have fewer cases of reduced lung function due to a slower paced lifestyle, less mechanized farming practices, more physical exercise and a lower incidence of tobacco smoking cannot be fully supported either. It does seem highly probable that the alternative hypothesis is substantially closer to the truth. The increased use of PPE and a reduction in smoking habits would undoubtedly improve the situation.

Discussion

Throughout this thesis the assumption has been made that the religious affiliation of the participants in this study has an effect on their respiratory health and well-being. While, this overall relationship is inconclusive, there appears to be sufficient support for further investigation. Respiratory problems may not be the best model to demonstrate how the Amish lifestyle may affect their health; however,
without a completely random sample, this cannot be stated categorically.

Clearly, the Amish use of symbolism and the pressure to conform to the rules of the church have a profound effect on their daily lives. The question which this thesis has attempted to address is whether their loyalty to rules of the church would override their concern for personal or communal health and safety. Their genuine concern for their health has been well documented (Hostetler, 1993, Kraybill, 1989, Heickes, 1985). If certain aspects of their lifestyle were demonstrated to be deleterious, how would they react? This question remains unanswered. However, the social theoretical aspects which have been argued here would suggest that the same driving force which leads them to perform dangerous or unhealthy behaviors would also bring near universal conformity if change were instituted through the leadership.

Despite performing tasks that have been demonstrated to place individuals in jeopardy for respiratory ailments, the evidence presented here does not support the need for an overriding concern in the Amish community. Physical exercise, slower lifestyle and a healthier way of life may all be contributing factors which keep the Amish healthy. However, there are some other interesting aspects about the Amish which manifested themselves during the course of this research. Perhaps the most interesting was the reaction of the Amish to the free lung function test.
Earlier reports that the Amish "do not accept free services, and, in fact, are angered by such" (Heickes, 1985) were not verified. Perhaps this was due to the clinical settings under which this study was conducted or the close association with the American Red Cross blood drive. The Amish participants in this study were often enthusiastic about learning the health of their lungs. Test results were given to each participant immediately following the testing and they often expressed their gratitude to the spirometry technicians. This inability to verify Heickes' findings may also be a result of variations between Amish Church districts. The efforts made to inform the community about the study, as outlined earlier, perhaps contributed to Amish acceptance of the free testing. However, it was apparent that many of those who participated had no prior knowledge about the lung function test.

The difference in findings (on this one issue) between this study and Heickes' thesis underscores the problem of making definitive statements about the Amish. Even the hypothesis postulated in this thesis, i.e., that the Amish lifestyle may be detrimental to their health, accentuates that determinative conclusions under the rubric "The Amish" may be misleading and universally incorrect.
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Appendix A

Consent Form
Consent To Investigational Treatment Or Procedure

I, _______________________, hereby authorize or direct Dr. Donald Thomas or assistants of his choosing, to perform the lung function test known as Spirometry upon myself.

The experimental (research) portion of the treatment or procedure is: The determination of the potential of restrictive or obstructive lung function among the Amish and non-Amish population of Wayne and Holmes Counties of Ohio.

This is done as part of an investigation entitled: An investigation of the potential for farmers lung disease in the Amish and non-Amish population.

1. Purpose of the procedure or treatment:

To detect the frequency of abnormal lung function in the test population.

2. Possible appropriate alternative procedure or treatment:

Participation in this study will be completely voluntary. All individuals will have an opportunity not to participate or to end their participation at any time.

3. Discomforts and risks reasonably to be expected:

Subject may feel somewhat exhausted after completion of the test. All individuals participating in the test will be allowed to rest as long as they feel necessary between the tests. A minimum of 5 tests will be performed on each subject (as prescribed by NIOSH). The maximum number of test any one subject will be asked to perform will be 8.

In some situations the subject may feel faint due to hyperventilation. All participants will stand directly in front of a solid chair while performing the test. If the subject begins to faint the technician in attendance will guide the individual into the chair and if necessary seek medical assistance. Registered nurses are on site and in the case of an emergency they are available to administer first aid.
4. Possible benefits for subjects/society:
   Conducting the test and the publicity surrounding it will increase the awareness of the potential for farmers lung among area residence. This awareness will occur within the community and among the general practitioners who service the area. Individuals with abnormal readings will be informed of their test results and encourage to see their physician for more information and diagnosis.

5. Anticipated duration of subject’s participation (including number of visits):
   The questions in the health history interview will take approximately 5-10 minutes to complete. The explanation of the testing procedure and the performance of the test will take between 10 and 15 minutes per individual. The interviews and testing will be conducted at the same time by different technicians.

   I hereby acknowledge that ______________________ has provided information about the procedure described above, about my rights as a subject, and he/she answered all questions to my satisfaction. I understand that I may contact him/her at (614) 292-6100 should I have additional questions. He/She has explained the risks described above and I understand them; he/she has also offered to explain all possible risks or complications.

   I understand that, where appropriate, the U.S. Food and Drug Administration may inspect records pertaining to this study. I understand further that records obtained during my participation in this study may contain my name or other personal identifiers may be made available to the sponsor of this study. Beyond this, I understand that my participation will remain confidential.

   I understand that I am free to withdraw my consent and participation in this project at any time after notifying the project director without prejudicing future care. No guarantee has been given to me concerning this treatment or procedure.

   In the unlikely event of injury resulting from participation in this study, I understand that immediate medical treatment is available at University Hospital of the Ohio State University. I also understand that the costs of such treatment will be at my expense and that financial compensation is not available. Questions about this should be directed to the Office of Research Risks, Biomedical Sciences Review Desk at (614) 292-9046.
I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date:_______ Time _______ AM PM

Signed:__________________________________________

I certify that I have personally completed all blanks in this form and explained them to the subject or his/her representative before requesting the subject or his/her representative to sign it.

Date:_______ Signed:

__________________________________________
(Signature of Project Director or his/her Authorized Representative)
Appendix B

Questionnaire
Lung Test Health Questions

Sex:  M  F  Height ______  Weight ______

General Questions
1. Name (Please include middle initial)
2. Address

3. To what church do you belong?

4. Age (Must be at least 18 years of age)

5. Females Only: Are you pregnant?
   no
   yes

6. Do you smoke?
   no
   yes
   (if yes) a. Have you smoked any cigarettes, pipes or cigars within the last hour?
      no
      yes

7. Have you used any inhaled medications, such as an aerosolized bronchodilator within the last hour? (If they answer yes ask them to come back in an hour)
   no
   yes

8. What have you eaten in the last hour? (If they have eaten a large meal in the last hour ask them to come back later)
   no
   yes

9. Have you had any respiratory infections, such as flu, pneumonia, severe cold or bronchitis within the last three weeks?
   no
   yes

10. Have you had any ear infections or problems in the last three weeks?
    no
    yes

11. Have you had any recent surgeries? (If the answer is yes they may not take the test until they have permission from the surgeon or their physician.)
    no
    yes

12. Did you grow up on a farm?
    no
    yes

13. Have you ever owned or operated a farm?
    no
    yes

14. What is your current occupation?
Lung Test Health Questions
Non-Farmers
1. Do you usually have a cough?
   no
   yes
   (if yes)a. Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?
      no
      yes

2. When you cough do you usually bring up phlegm from your chest?
   no
   yes

3. Does your chest ever sound wheezy or whistling:
   a. when you have a cold?
      no
      yes
   b. occasionally apart from colds?
      no
      yes

4. Have you ever had an attack of wheezing that has made you feel short of breath?
   no
   yes

5. Does your chest ever feel tight:
   a. when you have a cold?
      no
      yes
   b. occasionally apart from colds?
      no
      yes

6. Have you ever had:
   a. bronchitis?
      no
      yes
      (if yes) 1. Was it chronic?
      no
      yes
   b. pneumonia?
      no
      yes
   c. hay fever?
      no
      yes
   d. emphysema?
      no
      yes
      (if yes) 1. Do you still have it?
      no
      yes
   e. asthma?
      no
      yes
7. Are you troubled by shortness of breath (difficulty breathing) when hurrying on level ground or walking up a slight hill?
   no
   yes

8. Has a doctor ever told you that you had high blood pressure?
   no
   yes

9. Have you ever had treatment for heart trouble in the past ten years?
   no
   yes

10. Have you ever smoked cigarettes, a pipe or cigars?
    no
    yes
    (if yes) a. Do you now smoke?
        no
        yes
        (if yes) 1. How much do you smoke now? _______
        b. If you no longer smoke how old were you when you stopped? _______
        c. How old were you when you first started smoking? _______

11. What type of home heating unit do you have?
    a. Oil ______
    b. Wood ______
    c. Electric _____
    d. Gas ______
    e. Other ______

12. What type of cooking stove(s) do you have?
    a. Oil ______
    b. Electric _____
    c. Gas ______
    d. Wood ______
    e. Other ______

13. What type of lighting do you have?
    a. Electric ______ ______
    b. Gas ______
    c. Oil or Kerosene ______
    e. Other ______

14. Have you ever worked for more than one year at a dusty job?
    no
    yes

15. Have you been exposed to gas or chemical fumes on any job?
    no
    yes
Lung Test Health Questions
Farmers or former adult farmers.
1. Do you usually have a cough?
   - no
   - yes
   (if yes) a. Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?
     - no
     - yes
2. Do you usually cough during or following work in your barn?
   - no
   - yes
3. Do you usually cough during or following work in your silo?
   - no
   - yes
4. When you cough do you usually bring up phlegm from your chest?
   - no
   - yes
5. Does your chest ever sound wheezy or whistling:
   a. When you have a cold?
      - no
      - yes
   b. Occasionally apart from colds?
      - no
      - yes
   c. During or following work (up to 8 hours following) in your barn or silo?
      - no
      - yes
6. Have you ever had an attack of wheezing that has made you feel short of breath?
   - no
   - yes
7. Does your chest ever feel tight:
   a. when you have a cold?
      - no
      - yes
   b. occasionally apart from colds?
      - no
      - yes
   c. during or following work (up to eight hours following) in your barn or silo?
      - no
      - yes
8. Are you troubled by shortness of breath (difficulty breathing) when hurrying on level ground or walking up a slight hill?
   - no
   - yes
9. Have you noticed any difficulty breathing during or following work in your barn or silo?
   no 
   yes
10. Have you ever had:
   a. Bronchitis?
      no 
      yes
   (if yes) 1. Was it chronic?
      no 
      yes 
   b. Pneumonia?
      no 
      yes
   c. Hay fever?
      no 
      yes
   d. Emphysema?
      no 
      yes
   (if yes) 1. Do you still have it?
      no 
      yes 
   e. Asthma?
      no 
      yes
11. Has a doctor ever told you that you had high blood pressure?
    no 
    yes
12. Have you ever had treatment for heart trouble?
    no 
    yes
13. Have you ever smoked cigarettes, a pipe or cigars?
    no 
    yes
   (if yes) a. Do you now smoke?
      no 
      yes
   (if yes) 1. How much do you smoke now? ______
   b. If you no longer smoke how old were you when you stopped? ______
   c. How old were you when you first started smoking? ___
14. Have you ever been sick after uncapping a silo?
    no 
    yes
   (if yes) a. How many times have you been sick? ______
15. Have you ever been sick after handling hay or grain?
    no 
    yes
(if yes) a. How many times have you been sick? _______

16. What type of home heating unit do you have?
   a. Oil ______
   b. Wood ______
   c. Electric ______
   d. Gas ______
   e. Other ______

17. What type of cooking stove(s) do you have?
   a. Oil ______
   b. Electric ______
   c. Gas ______
   d. Wood ______
   e. Other ______

18. What type of lighting do you have?
   a. Electric ______
   b. Gas ______
   c. Oil or Kerosene ______
   e. Other ______

19. Which of the following would apply to the type of farming you do:
   a. dairy
   b. beef
   c. swine
   d. poultry
   e. grain
   f. other ______

20. Do you store forage (circle yes or no to the following)
   a. stacked or rolled
      no
      yes
   b. baled
      no
      yes
   c. silage
      no
      yes
   d. other methods
      no
      yes

21. Have you ever worked for more than one year at other dusty jobs?
   no
   yes

22. Have you been exposed to gas or chemical fumes in any other job?
   no
   yes
Appendix C

Samples of Report of Spirometry Findings
Report of Spirometry Findings

Tim Lawrence
590 Woody Hayes Dr.
Columbus, OH 43210-1057
(614) 292-6131

ID:C52  Test Date: 6/23/93  Time: 2:12 pm
Age: 52  Height: 165 cm  Sex: M  System: 5 17 14

<table>
<thead>
<tr>
<th>Trial</th>
<th>FVC</th>
<th>FEV1</th>
<th>FEV1/FVC%</th>
<th>PkFlow</th>
<th>FEF25-75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.15</td>
<td>3.12</td>
<td>75.2%</td>
<td>6.57</td>
<td>2.43</td>
</tr>
<tr>
<td>2</td>
<td>4.30</td>
<td>3.01</td>
<td>70.0%</td>
<td>9.55</td>
<td>1.71</td>
</tr>
<tr>
<td>3</td>
<td>4.26</td>
<td>3.00</td>
<td>70.4%</td>
<td>9.20</td>
<td>1.71</td>
</tr>
<tr>
<td>4</td>
<td>4.32</td>
<td>3.02</td>
<td>69.8%</td>
<td>9.30</td>
<td>1.65</td>
</tr>
<tr>
<td>5</td>
<td>4.31</td>
<td>2.98</td>
<td>69.2%</td>
<td>9.87</td>
<td>1.52</td>
</tr>
</tbody>
</table>

Best Values  
4.32  3.02  69.8%  9.87  1.65

Predicted Values-1  
3.59  2.94  81.2%  3.15

LLN-2  
2.63  2.27  70.5%  1.27

Percent Predicted  
120.2%  102.6%  86.0%  52.6%

Interpretations:
Breathing test results are within normal limits.

2 - LLN is the Lower Limit of the Normal range (95th percentile).

Note: An *C indicates a trial was technically unsatisfactory
due to a cough and an *E due to an extrapolated volume > 5%.

14L/s Flow-Volume Curves

Figure 3. Test Results of Subject C52. Test results are
within normal expected limit for an individual of their sex,
height and age. Subjects were able to see how well they
performed after each test.
Report of Spirometry Findings

Tim Lawrence
590 Woody Hayes Dr.
Columbus, OH 43210-1057
(614) 292-6131

ID:C54  Test Date: 6/23/93  Time: 3:27 pm
Age: 52  Height: 157 cm  Sex: F  System:13 17 14

<table>
<thead>
<tr>
<th>Trial</th>
<th>FVC</th>
<th>FEV1</th>
<th>FEV1/FVC%</th>
<th>PkFlow</th>
<th>FEF25-75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.93</td>
<td>1.76</td>
<td>60.2%</td>
<td>4.62</td>
<td>0.84</td>
</tr>
<tr>
<td>2</td>
<td>2.94</td>
<td>1.80</td>
<td>61.3%</td>
<td>4.73</td>
<td>0.88</td>
</tr>
<tr>
<td>3</td>
<td>3.09</td>
<td>1.86</td>
<td>60.0%</td>
<td>4.64</td>
<td>0.85</td>
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<tr>
<td>4</td>
<td>3.12</td>
<td>2.00</td>
<td>63.9%</td>
<td>5.06</td>
<td>0.95</td>
</tr>
<tr>
<td>5</td>
<td>3.03</td>
<td>1.93</td>
<td>63.6%</td>
<td>4.92</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Best Values: 3.12  2.00  63.9%  5.06  0.95
Predicted Values-1 2.90  2.40  82.7%  2.62
LLN-2 2.08  1.74  71.0%  1.49
Percent Predicted 107.7%  83.1%  77.2%  36.4%

Interpretations:

FEV1/FVC% results are below the normal range. The reduced rate at which air is exhaled indicates mild obstruction to airflow.

2 - LLN is the Lower Limit of the Normal range (95th percentile).

Figure 4. Test Results of Subject C54. Test results were below the expected normal range.
Appendix D

Correlation Tables
Table 9. Correlation With Test Subject C50 Included.

<table>
<thead>
<tr>
<th></th>
<th>PEVI/FVC</th>
<th>Smoked</th>
<th>Ever Smoked</th>
<th>Any Cough</th>
<th>Barn Cough</th>
<th>Silo Cough</th>
<th>Barn Breath</th>
<th>Silo Sick</th>
<th>Hay Sick</th>
<th>Dust Job</th>
<th>Chem Job</th>
<th>Ever Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoked</td>
<td>-0.064</td>
<td>0.278</td>
<td>-0.128</td>
<td>0.018</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Ever Smoked</td>
<td>0.278</td>
<td>-0.064</td>
<td>-0.128</td>
<td>0.018</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Any Cough</td>
<td>0.018</td>
<td>0.278</td>
<td>-0.128</td>
<td>0.018</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Barn Cough</td>
<td>-0.044</td>
<td>0.018</td>
<td>-0.128</td>
<td>0.018</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Silo Cough</td>
<td>-0.285</td>
<td>-0.044</td>
<td>-0.128</td>
<td>0.018</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Barn Breath</td>
<td>-0.122</td>
<td>-0.285</td>
<td>-0.128</td>
<td>0.018</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Silo Sick</td>
<td>-0.372</td>
<td>-0.122</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Hay Sick</td>
<td>-0.279</td>
<td>-0.372</td>
<td>-0.122</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.044</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
</tr>
<tr>
<td>Dust Job</td>
<td>-0.171</td>
<td>-0.279</td>
<td>-0.372</td>
<td>-0.122</td>
<td>-0.285</td>
<td>-0.122</td>
<td>-0.044</td>
<td>-0.372</td>
<td>-0.279</td>
<td>-0.171</td>
<td>0.122</td>
<td>-0.070</td>
</tr>
<tr>
<td>Chem Job</td>
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<td>0.122</td>
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<td>Ever Farm</td>
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<td>-0.119</td>
<td>0.075</td>
<td>-0.093</td>
<td>0.078</td>
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<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>-0.206</td>
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</table>

* Note  * All values in column are identical
Table 10. Correlation Without Test Subject C50 Included.

<table>
<thead>
<tr>
<th></th>
<th>FEV1/FVC</th>
<th>Smoked</th>
<th>Ever Smoked</th>
<th>Any Cough</th>
<th>Cough</th>
<th>Barn Cough</th>
<th>Cough Silo</th>
<th>Barn Breath</th>
<th>Silo Sick</th>
<th>Hay Sick</th>
<th>Dust Job</th>
<th>Chem Job</th>
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</thead>
<tbody>
<tr>
<td>Smoked</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever Smoked</td>
<td>-0.111</td>
<td>0.282</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Cough</td>
<td>0.043</td>
<td>0.013</td>
<td>0.062</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>0.003</td>
<td>0.056</td>
<td>0.029</td>
<td>0.270</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barn Cough</td>
<td>-0.207</td>
<td>-0.092</td>
<td>0.147</td>
<td>0.133</td>
<td>0.031</td>
<td></td>
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<tr>
<td>Silo Cough</td>
<td>0.027</td>
<td>-0.069</td>
<td>0.185</td>
<td>0.042</td>
<td>-0.100</td>
<td>0.678</td>
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<tr>
<td>Barn Breath</td>
<td>-0.285</td>
<td>-0.073</td>
<td>-0.013</td>
<td>0.090</td>
<td>0.096</td>
<td>0.232</td>
<td>-0.080</td>
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</tr>
<tr>
<td>Silo Sick</td>
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<td>-0.071</td>
<td>0.204</td>
<td>0.191</td>
<td>-0.104</td>
<td>0.277</td>
<td>0.187</td>
<td>0.187</td>
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<tr>
<td>Hay Sick</td>
<td>-0.123</td>
<td>0.156</td>
<td>0.341</td>
<td>-0.009</td>
<td>-0.132</td>
<td>0.232</td>
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<td>0.032</td>
<td>0.191</td>
<td>0.210</td>
<td>0.136</td>
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<td>Ever Farm</td>
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* Note: * All values in column are identical
Table 11. Correlation With Old Order Amish Only.

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<th>FEV1/FVC</th>
<th>Smoked</th>
<th>Ever Smoked</th>
<th>Any Cough</th>
<th>Barn Cough</th>
<th>Silo Cough</th>
<th>Silo Sick</th>
<th>Hay Sick</th>
<th>Dust Job</th>
<th>Chem Job</th>
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* Note: All values in column are identical
Table 12. Correlation With New Order Amish Only

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<th>Cough</th>
<th>Barn Cough</th>
<th>Barn Breath</th>
<th>Hay Sick</th>
<th>Dust Job</th>
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* Note: All values in column are identical
END OF

THESIS