THE SHETLAND ISLANDS: THE EFFECTS OF SOCIAL AND ECOLOGICAL CHANGE ON MENTAL HEALTH

ABSTRACT. The authors review the literature concerning the mental health and social effects of industrialization, urbanization and the transition from a rural to an industrial society. They point out the need for prospective and longitudinal studies. To illustrate a working model of the type of research needed, the authors describe a long-term study now underway in the Shetland Islands. This research investigates the effects that rapid social and ecological change (from the North Sea oil developments) will have on the islanders. To test the hypothesis that the changes, associated with the construction of Europe's largest oil port in these previously isolated rural islands, will have a deleterious effect on the Shetlanders' health and way of life, a prospective study has been initiated that contains two sub-studies. The General Survey involves monitoring reported data on ecological, epidemiological and sociological change and is intended to provide an overview of the general impact of the oil developments. The Individual Survey involves interviewing two populations (total \( N = 533 \)) and is designed to examine individuals' reactions to change and variables associated with those reactions. The target population live in and around a designated oil-related industrial zone. The control population live in a conservation region where they are not likely to be directly affected by the oil developments. Baseline findings are presented from the General Survey concerning psychiatric morbidity, crime, divorce and suicide and from the Individual Survey that focus on the prevalence of medical and psychiatric symptoms and illnesses.

INTRODUCTION

The Shetland Islands are currently undergoing a period of rapid social and ecological change brought about by the discovery of North Sea oil off its shores. The introduction of a major industry to this previously rural, seafaring community will undoubtedly alter the way of life of the Shetlanders. Whether this period of social change will be deleterious to the mental health and social order of the islanders is the focus of a long-term study reported here.

To our knowledge there have been no longitudinal studies carried out in a society that is undergoing the process of industrialization, where individuals have been assessed at intervals to determine, not only the immediate, but also the long-term effects of such change on their mental health. We will discuss the methodology of, and present some preliminary baseline findings from, our Shetland research which represents such a prospective and longitudinal study. However, before we do this, it is important to provide some background information in the form of a review of pertinent literature.

In this paper, social and ecological change will be limited to the mental health effects of industrialization, urbanization and the transition from a rural, non-industrialized and traditional society to an urban, industrialized, and modern one. Comprehensive reviews of the general topic 'social change and

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mental health’ have been published previously (Murphy 1961; Coelho 1972). Additional reports have dealt with specific types of social and ecological change such as natural and man caused disasters (Cobb and Lindermann 1943; Kardiner and Spiegel 1947; Baker and Chapman 1962; Popovic and Petrovic 1965; Lifton 1967; Krystal 1968; Chodoff 1970). This paper will not concern itself with the broad issue of culture and mental disorder; several excellent reviews have already appeared in the literature (Eaton and Weil 1955; Senay and Redlich 1968; B. P. Dohrenwend and B. S. Dohrenwend 1974b; Dunham 1976).

For over a century there has been debate about whether or not industrial civilization, with all its social and ecological changes, has led to increases in psychiatric disorders. As early as 1830, Esquirol (1830) attributed an increase in the rate of mental illnesses to the progress of industry, commerce, and civilization in general. Later, Kraepelin (1909) also suggested that the stresses of civilization had led to an increase in psychiatric disorders, particularly depression.

Several contemporary social scientists support these early contentions that more mental disturbances are found in modern industrial societies. Their theories differ, however, regarding the importance assigned to specific variables in the etiology of the disorders. Mead maintained that urbanization and subsequent cultural changes posed a serious threat to both personality and social integration (Mead 1947a) and that changes that increased the heterogeneity and complexity of a society give rise to “more and more special forms of psychosomatic expression” (Mead 1947b). Mead’s assumption that ‘primitive’ and nonindustrialized societies were less complex and less stressful than modern societies has been called into question (Beaglehole 1949). According to Wallace, heterogeneity and cultural change per se do not lead to increases in neurotic and psychosomatic complaints but, rather, these are the responses of individuals to the more complex society’s failure to meet their needs and wants (Wallace 1961).

**INDUSTRIALIZATION¹, URBANIZATION² AND MENTAL HEALTH**

Slotkin maintains that rapid industrialization leads to severe cultural disorganization which in turn produces social and personal maladjustment (Slotkin 1960). Cassel and Tyroler studied the health and mental effects of the dramatic social changes that accompany industrialization. In their study of a small industrial city in North Carolina, they found that ‘first generation’ factory employees (the people who had most recently undergone the change from a rural ‘folk’ culture to an industrial social situation) complained of more total symptoms, and had more symptoms relating to mental disorders than second generation workers (the children of previous factory workers) (Cassel and Tyroler 1961).
An increase in psychiatric disorder has been linked to industrialization and culture change in Africa (Field 1960; A. Leighton et al. 1963). In an address to an international meeting on 'Industrialization and Mental Health', in 1964, Lambo (1965) said that "industrialization in its present form and speed contributes to social disintegration and conflict". Studies carried out in Africa of communities that had experienced rapid industrialization found higher prevalence rates (when compared to control populations) of the following: delinquency, drug addiction, alcoholism, prostitution, venereal disease, crime, and sociopathic behavior (Lambo 1965). It was felt that these problems were caused by the erosion of traditional ways, with changes in attitudes and values and a decreased sense of belonging, and the dissolution of primary familial bonds, leading to the social isolation of individuals.

Rapid social change in the form of accelerating industrialization is also taking place in the Arab world. A recent report from Cairo indicates that rapid industrialization tends to produce significantly higher rates of depression among village migrants who moved from rural areas to work in the city's factories (El Sendiony, Abou-El-Azaein and Luza 1977).

Sasaki (1960) found that the rapid change from a poor, nonindustrialized community to a relatively affluent and industrialized one, correlated positively with an increase in broken families, divorces, neglected children, alcoholism, and lawlessness. Sasaki originally was collecting baseline social data to study the effect of the introduction of new agricultural techniques upon the community, but he changed his focus when oil was unexpectedly discovered in the vicinity. It is uncommon that an investigator can anticipate such rapid industrialization and change and carry out the necessary baseline studies from which change can be measured. Had Sasaki not been in the area collecting baseline data before oil was discovered, perhaps there would not have been enough time for investigators to collect such data before environmental and mental health changes began to occur.

According to Sorokin, industrial and modern life are not intrinsically unhealthy, rather, it is the difficult change to the industrial modern way of life that is stressful (Sorokin 1957). Some investigators, however, do not associate modernization and urbanization with stress and an increase in psychological disturbance. Srole has suggested that there is a need for a reformulation regarding urbanization and mental health (Srole 1972). He maintains that "a mobile society, catalyzed by urbanization, is on the whole, psychologically eugenic, whereas an immobile society that holds its members as local captives is more pathogenic". Inkeles and Smith (1974) carried out a large-scale, cross-cultural, six-nation study involving nearly 6,000 men. They found no significant difference in the levels of psychiatric symptomatology in men living in urban and in rural settings. In fact, they found that "the more modern the individual
the better his psychic adjustment as measured by the Psychosomatic Symptoms Test". However, because the study was carried out only with working men between the ages of 18 and 32 years, generalizations from this work must be limited, and there is a need for a thorough test of the hypothesis involving a population with more diverse demographic characteristics.

URBAN AND INDUSTRIAL ENVIRONMENTS

Other studies have attempted to measure the mental health of a population living in an industrialized and urbanized environment. Most of these present the ‘after’ pictures, in that they have taken place in urban centers long after a significant degree of industrialization has occurred. These studies disclose a fairly consistent pattern of higher rates of mental disorder (except for manic-depressive illness) in economically depressed areas of cities and among the poor. These results are significant in that future research can be designed to determine whether people who become mentally disturbed are unable to obtain gainful employment and ‘drift’ eventually into these poorer sections of cities, or whether living in these areas plays a role in the etiology of mental disturbance. Faris and Dunham, in one of the first ecological studies of mental disorder in an urban environment, found that higher rates of poverty, unemployment, crime and suicide were also present in the city center versus its periphery (Faris and Dunham 1939). In later work, Faris further developed the theory from his and Dunham’s 1939 work, that the central city is an area of high mobility and social disorganization, populated mainly by the poor, and that this mobility acts as a form of isolation that might tend to precipitate the isolation behavior of the schizophrenic (Faris 1947).

A more recent examination of the mental health of an urban population can be found in the Midtown Manhattan study (Srole et al. 1962; Langner and Michael 1963) a study of the prevalence of psychiatric disorder in an urban setting. Interviews were carried out by trained personnel, and then psychiatrists, on the basis of the interview material, determined the gross typology of mental disturbances and the degree of impairment. The results indicated that 25 percent of the individuals interviewed were psychiatrically impaired and that no fewer than 81.5 percent had symptoms of some sort. Using a similar methodology, the Stirling County Survey, a major epidemiological study in a rural setting (Nova Scotia), found that 24 to 42 percent of the persons interviewed were psychiatrically impaired and that 57 to 69 percent were considered ‘psychiatric cases’ (Leighton 1959; Hughes et al. 1960; D. C. Leighton et al. 1963). The theory developed in the Stirling County Survey is similar to Faris and Dunham’s theory of social disorganization. Leighton and coworkers found “a much higher prevalence of psychiatric disorders in the disintegrated groups than in others”
(D. C. Leighton et al. 1963). Social disintegration, according to these investigators, can occur in all communities, rural and urban.

Urban—rural differences in mental disturbances have been reviewed by B. P. Dohrenwend and B. S. Dohrenwend (1974a). They conclude that "the most reasonable hypothesis appears to be that total rates of psychopathology are somewhat higher in urban than in rural areas, due at least in part to an excess of neurosis and personality disorder in the urban areas". They point out, however, that such overall differences are not great and that the higher urban rates do not hold for psychosis, since rates for all psychoses combined tend to be higher in the rural areas. The fact that higher rates of psychopathology are found in urban areas does not demonstrate that living in a city places an individual at a greater risk to develop mental illness, as no studies attempted to account for which came first—the illness or the environmental milieu. It is clear that studies of the inhabitants of urban areas can only provide us with indirect information about the effects of the industrialization and urbanization process on mental health.

**ADAPTATION TO STRESS AND CHANGE**

Selye has pointed out that the failure to adapt to the stresses of "the ever-changing conditions of this globe" has given rise to many common diseases such as nervous and emotional disturbances, high blood pressure, gastric and duodenal ulcers, and certain types of rheumatic, allergic and cardiovascular diseases (Selye 1956). However, as has been noted by several researchers, reaction to stress must be examined in light of the individual's attitudes to stressors, because change or stress that the individual perceives as threatening to him (whether others do or not) poses a greater problem to the individual's ability to adapt to that change (Wolff 1950; Hinkle 1974; Mechanic 1974; Brown 1974; Horowitz 1976). Therefore, as a community changes from rural and traditional to urban and modern, a mere examination of the physical and psychological changes that occur would mean little without an examination of the attitudes the people in that community have toward the change.

Implicit in the discussion of how industrialization and modernization affect mental health, is the notion that as a community becomes more industrialized and modern, new expectations are made of the community members regarding, for example, the kind of work they will do and the types of social activities in which they will take part. In short, a basic assumption is that changes will occur in a person's life. Attempts to quantify change in an individual's life were initiated in the work of Holmes and Rahe (1967), who showed a positive relationship between the number of life-change units experienced over a given time period and the onset of illnesses. There has been increasing interest in measuring life events and determining how these interrelate with medical and
psychological symptoms and illnesses (Gunderson and Rahe 1974; B. S. Dohrenwend and B. P. Dohrenwend 1974b). Rahe (1969) has demonstrated that the degree of life change has pathogenic significance, and this is important since the greater the number of life changes, the greater the risk for subsequent morbidity. Horowitz and coworkers have shown that recent events are rated as more stressful than remote events (Horowitz, Schaefer and Cooney 1974).

Levi and Cobb have outlined models for understanding how the industrialization process and stressful life events, respectively, lead to the onset of medical and psychiatric symptoms and illnesses (Levi 1974; Cobb 1974). Both emphasized the interacting variables of the psychosocial stimuli, past experience, genetic predisposition, social situation, psychological defenses and coping mechanisms, and disease. During stressful periods of rapid social change due to industrialization and urbanization, it has been suggested that some people are more vulnerable to environmental influences than others. It has been shown that this is particularly true for the young, the elderly, and the handicapped (Murphy 1961; Carlestrom and Levi 1971).

RAPID SOCIAL CHANGE, MODERNIZATION AND MENTAL HEALTH

Chance (1960) describes an Eskimo community that underwent a rapid social change3 due to the construction of a nearby DEW line radar station, and benefitted from the experience. He felt the key intervening variables affecting this community’s successful adjustment to the rapid social and cultural changes were as follows:

(1) The people had a *predisposition to change* already built into their socio-cultural system in that a greater value was placed on adaptability than on conformity.
(2) They *voluntarily chose to change* large segments of this system to fit a Western model.
(3) The majority of the goals associated with these changes were capable of realization.
(4) They participated in the changes together as a group.
(5) Most major alterations in previous life-patterns occurred together in such a way as to preserve a total culture balance.
(6) The people were able to maintain control over their own internal affairs without outside coercion.

Chance (1960) refers to four other studies which describe communities that have experienced rapid social change with little disruptive effect (Redfield 1950; Mead 1956; Adams 1959; Nash 1958). These studies contrast sharply with
others in which societies were unable to cope with rapid social changes and the effects were destructive and led to social disorganization and to increases in health and social problems (Field 1960; A. H. Leighton et al. 1963; Lambo 1965; El Sendiony, Abou-El-Azaein and Luza 1977; Sasaki 1960; Lubart 1969; Parakin 1974; Lapuz 1976).

Why are some groups able to adjust while others are not? Cultures appear to be like individuals and successful adaptation seems to be associated with a positive and strong sense of identity (separate language or dialect, folklore, traditional values, close-knit families and communities) and an active and organized approach to the coming change. Community planning can play a key role in determining a successful outcome. Societies are unique and each cultural group will ideally respond in ways conducive to promoting the health and well-being of the community as a whole (Duhl 1976).

NEED FOR PROSPECTIVE AND LONGITUDINAL STUDIES

The relationships between the industrialization and modernization processes and mental health are obviously complex and ones that are difficult to study. Many investigators concerned with psychiatric epidemiology have suggested that prospective longitudinal studies provide a clearer understanding of the etiology of mental disorders (B. P. Dohrenwend and B. S. Dohrenwend 1974a and b; Cooper 1973; Kiev 1972; Reid 1960; Opler 1956; Cassel 1974).

Lin (1962) states that:

prospective longitudinal studies of a general population may be regarded as an ideal method of obtaining epidemiological data on mental disorder, provided the sample remains reasonably stable and the research design constant throughout the whole period. One great advantage of prospective studies is that they permit the collection of accurate and objective information on uniform materials, independent of histories based on personal recollection. Moreover, they diminish the risk that the observer may interpret past histories in the light of the hypothesis the study is designed to test. Prospective studies of this type can provide accurate information not only on the onset and evolution of mental illness, but also on the little-explored question of spontaneous recovery. In other words, this type of study may clarify the natural history of mental disorder .... Since the sample is under observation over a period, a better understanding is possible of the roles of predisposition and environmental factors in determining the onset of mental disorder. The time-lag between the onset of the illness and the discovery by the community can also be observed more accurately. A greater awareness of social changes and attitudes in relation to mental disorder becomes possible.

Mechanic (1974) supports the use of longitudinal studies and adds, "In the near future we have the most to learn from field studies of adaptation to particular stress events over time. Such involvement requires greater emphasis on prospective and processual studies." In the summary of the Stirling County
Study, Leighton discusses the most desirable form of research needed: “Incidence is, by its nature, a more sensitive indicator than prevalence for detecting responses to variations in circumstances. If large probability samples are drawn and the same individuals re-examined at intervals, the results would have the advantage of incidence, plus a general increase in our appreciation of variation through time” (Leighton, D. C. et al. 1963). In following a sample from the Stirling County Study for five years, Beiser and Leighton were able to identify factors associated with the remission of psychiatric symptoms in persons with neurotic disorders (Beiser 1972; Beiser and Leighton 1976; Beiser 1976). Realizing the importance of longitudinal studies, Srole and coworkers carried out a twenty-year follow-up of the Midtown Manhattan Study. The preliminary results indicate that “about one-third” of the subjects who were reinterviewed had “better mental health”, whereas “roughly one-fourth” had “less favorable levels of emotional health” and two-fifths remained unchanged (Srole 1975).

In order to illustrate a working model of the type of research that is needed, we will now discuss a long-term study that is now underway in The Shetlands Islands.

THE SHETLAND HEALTH STUDY

Until 1972, the Shetland Islands were known primarily for their ponies and wool sweaters. Few people, even in Great Britain, knew the remote location of these windswept islands in the North Sea, 250 miles north of Aberdeen, Scotland and 250 miles east of Bergen, Norway. The veil of anonymity was lifted when it was announced that massive quantities of oil had been discovered off Shetland’s eastern shores and plans were made to construct Europe’s largest oil port in Sullom Voe, a bay on the main island.

There are some intrinsic qualities of the Shetland Islands that are quite desirable for a prospective and longitudinal study. First, Shetland’s geographic isolation tends to prevent migration. A lack of housing (except for a special work camp for construction workers) presently limits in-migration of families and the local government plans to control the rate at which new houses are built. A factor currently controlling out-migration is the present economic prosperity. There has been little unemployment in the islands since the mid-1960’s; first, because of the success of the fishing and knitting businesses, and now because of oil-related work. With jobs available, strong family and cultural ties tend to prevent a Shetlander from moving. Thus, at present the endogenous population is a relatively stable one, a necessity in a long-term follow-up study.

The homogeneity of the population also makes Shetland attractive for a study of this kind. The way of life and livelihood, which in the past centered
around fishing, knitting and crofting or subsistence level farming, is similar for
the majority of islanders. Most people are born and raised in the islands and as a
result there is a ‘collective Shetland identity’. There is a strong feeling of
community and a sense of belonging, exemplified by the native dialect, music,
dances, customs, and folklore (Nicolson 1972; Zetland County Council 1973;
Marwick 1975).

Shetland’s greatest asset for a prospective longitudinal study is the unique
phenomenon that is taking place there. By 1980, Shetland will be a major
receiving and processing site for North Sea oil, and the character of the islands
will change from a basically rural and seafaring existence to a more industrialized
one. The magnitude of the change is apparent when one considers that if
Shetland were an independent country, it would be the sixth largest oil
producing nation in the world (Clark 1975). Since the oil fields are all more than
60 miles offshore, a great deal of time has been required to lay oil pipelines. This
circumstance plus delays resulting from adverse weather conditions (with waves
over 75 feet high and gales with winds over 116 m.p.h.) and technological
problems provided adequate time and opportunity for us to collect baseline data
of a medical, psychological, social and ecological nature from which later change
can be measured. Because such a large amount of oil was discovered, the oil
industry will be in Shetland for at least 30 to 50 years; therefore, the effects on
people can be studied over a long period of time.

There are other valuable aspects of Shetland’s unusual ‘experiment in nature’.
The local government succeeded in getting a bill through the British parliament
that helps them contain and control the oil developments: by law all major oil
related industrial developments must be built in the Sullom Voe region. Also, in
order to encourage preservation of the traditional Shetland landscape and way of
life, certain areas of the islands have been designed as conservation zones where
no major development, oil or otherwise, can take place. While the lives of those
living in a conservation area will probably be somewhat affected by the oil
developments, they should not feel the impact as strongly as the people living in
and around Sullom Voe. Thus, a quasi-experimental situation was established in
which one population would be directly affected by the oil developments and
others only indirectly.

OVERALL DESIGN AND METHODOLOGY

The primary objective of our Shetland Health Study is to try to determine
whether or not the change from an isolated, rural community to a more
industrialized one, over a relatively short period of time, will adversely affect the
mental health of the islanders and bring about an increase in such indices of
social disorder as crime, divorce, and suicide. It is our hypothesis that
industrialization and the consequent social changes will have a deleterious effect upon the islander's way of life and mental health that can be measured over time.

To test this hypothesis, in 1975, we initiated a longitudinal and prospective study that contains two major sub-studies. The first of these, the General Survey, examines treated psychiatric morbidity and certain social and physical changes that are expected to occur on the islands and in its population over time. The second, the Individual Survey, consists of interviewing two populations, (a) a target population living in direct proximity to the planned Sullom Voe oil complex, and (b) a control population living in a conservation region and less likely to be directly affected by the developments. Because some oil related construction had begun when we started interviewing in 1975, the data for the Individual Survey were collected during an early transition phase of Shetland becoming more industrialized. The first follow-up study for both the General and Individual Survey is scheduled for the spring and summer of 1978.

THE GENERAL SURVEY

For the General Survey, we obtained baseline data for a 12-year period (1963–1975) before the major oil developments on the following: reported psychiatric morbidity and figures on crime, suicide, divorce, and air, water and noise pollution levels, population and pre-oil medical and social services.

Data on treated psychiatric morbidity were provided by the University of Aberdeen’s Mental Health Research Unit. Five times a year, the Kingseat Hospital, affiliated with the University of Aberdeen, holds a psychiatric clinic in Shetland when psychiatrists see individuals who have been referred by their local general practitioners. This is primarily an outpatient clinic, but individuals can be referred to the inpatient service. Shetland general practitioners also send patients directly to Kingseat Hospital when need arises between clinic visits. At the clinics each person is interviewed prior to psychiatric examination, to gather demographic data and information about psychiatric and medical history. This information is coded, along with admission and discharge diagnosis and modes of treatment to form part of the computerized North East Scottish Psychiatric Case Register. An up-to-date file is kept in Aberdeen, and each time an individual is seen, a report is placed in his or her records. Data on crime, suicide, divorce, and pollution were gathered from official British government publications.4

THE INDIVIDUAL SURVEY

In order to obtain baseline data of a more specific and personal nature, we conducted structured interviews and administered questionnaires to 533
individuals between the ages of 15 and 60 years who lived in the target and control regions. A stratified random sample was drawn to reflect the age and sex characteristics of the two areas. The sampling was done from the National Health Service Rolls which were first up-dated with the general practitioners in the target and control regions. The Shetland County Health Board reports the National Health Service Rolls include at least 95 percent of the population.

Individuals to be sampled were then sent a letter from their general practitioner introducing the coinvestigators and the other physician and nurse who assisted with the interviewing. The letter explained that we were conducting a General Health Survey that involved the subject answering some questions regarding his or her health and way of life. Most interviews were carried out in the subjects' home, to minimize inconvenience to them. Before each interview, the subject was given a consent form to sign which explained generally what their involvement in the study would entail and also informed them that all the information obtained from the interview and questionnaires was completely confidential and that all subjects would remain anonymous.

The structured interviews asked questions concerning demographic characteristics, socio-economic status, medical history, psychosomatic symptoms experienced in the previous year, stresses present in work, financial, community, and family life, support systems and coping styles, and level of 'modernity'.

Questions concerning all the above were to be included in the interview, and the following three forms were given to the subject to complete at the end of the interview:

a. Recent Life Events Questionnaire – as developed by M. Horowitz – (Horowitz, Schaefer and Cooney 1974)

b. General Health Questionnaire (a 60-item psychiatric symptom question-naire developed by D. Goldberg (1972))

c. Attitude Scale (10-item scale designed to measure general favorable versus unfavorable attitudes to the oil developments)

The Recent Life Events Questionnaire and items regarding stressors in an individual's work, economic, community, and family situation were included in an attempt to understand how these variables affect the relationship, if any, between rapid social change and symptom and disease formation. It has been reported that there is a significant overall correlation between increased life events and physical and psychological symptoms (Rahe 1974; Markush and Favero 1974). We are interested in examining whether the industrialization process is associated with an increase in life events and if an increase in life events also correlates positively with increased medical and psychosomatic symptoms.
We elected to study symptoms of psychiatric disturbances rather than to attempt to diagnose 'psychiatric cases', and chose the General Health Questionnaire (GHQ) for measuring current psychiatric symptomatology, not only because it is a reliable and objective method, but also because it is economical, simple to administer, and would be easy to replicate in other studies (Goldberg 1972). The General Health Questionnaire is a 60-item, self-administered questionnaire developed in Great Britain that takes only 10 to 15 minutes to complete. Because the GHQ is designed to detect symptoms present only in the past three to four weeks, we also included questions in our interview guide regarding psychosomatic symptoms experienced in the past year. This was done to try to make our measurement of symptoms more comprehensive.

All information concerning the subject's report of illnesses, treatment for illness or symptoms, and use of medication was cross-checked with their general practitioner for validation (prior to signing the consent form the subject was told we would check with his or her doctor regarding only the medical questions to assure that that information was as accurate as possible).

The questions in the interview concerning stresses in one's work, economic, community, and family life were drawn from the 'Problems of Everyday Life' questionnaire developed by Dr. L. I. Pearlin at the National Institute of Mental Health. These items were included to try to ascertain what relationship they might have with the industrialization process, and to try to determine if these stressors were acting independently to influence symptom or disease formation. For example, if people living in the target area reported a significantly higher number of these problems on follow-up than those living in the control region, a case could be made that the changes associated with industrialization included a higher incidence of these stresses in their lives. However, if there is no significant difference between the rates of symptom or disease formation in the two populations, we will determine whether reports of increased physical and mental symptoms correlate with increased reports of stress in the subjects' family, work, and/or community life.

Also drawn from the 'Problems of Everyday Life' questionnaire are certain items designed to measure the coping mechanism of denial. We believe that basic styles of coping act as intervening variables and can significantly affect an individual's response to stressors, and it is important to attempt to measure what influence coping mechanisms have on the formation of symptoms and diseases.

Another intervening variable examined is degree of 'modernity' as measured in the O.M. Scale developed by Inkeles (Inkeles and Smith 1974). Data from the O.M. Scale also might help to describe the process of a change to a more industrialized community. For example, is the industrialization process associated with a shift from traditional attitudes to more 'modern' ones? If so, according to Inkeles and Smith's findings one would expect fewer psychosomatic symptoms in individuals with high modernity scores.
THE SHETLAND ISLANDS

All interviews were completed by the end of January, 1976, and, with a few exceptions, each interview was conducted with just the interviewer and subject present. The total number of people interviewed was 263 in the target area and 270 in the control region. The refusal rates were 22.65 percent and 21.05 percent, respectively, for the target and control areas. In the target region 90 percent of the population was sampled and in the control region 83 percent of the population was sampled.

PRELIMINARY RESULTS

The following is a summary of the findings from the General Survey, and some of the findings from the Individual Survey with a focus on the prevalence of psychiatric symptoms and 'cases' in the interviewed population.

The General Survey

Population. – During the past century, the population of Shetland gradually decreased from 31,670 in 1861 to a low of 17,245 in 1966. With the economic prosperity of the late 1960's and the discovery of oil, the population increased to 17,327 in 1971 and to an estimated 19,069 in 1975. The female to male ratio has begun to equalize in recent years. The 1951 ratio of females to males was 115 to 100, in 1961 it was 109.3 to 100 and in 1971 it was 107.7 females to 100 males. This increase in the number of males in Shetland is due, in part, to better economic conditions that have allowed working-age men to stay in Shetland. The trend of out-migration was reversed in the period from 1966 to 1971 and a population increase was documented as a result of both natural increase and in-migration.

TABLE I
Total number of psychiatric patients per year
and one-year prevalence rates

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<tr>
<td>other**</td>
<td>3%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>neuroses</td>
<td>39%</td>
<td>36%</td>
<td>40%</td>
<td>39%</td>
</tr>
<tr>
<td>depressive</td>
<td>27%</td>
<td>23%</td>
<td>29%</td>
<td>28%</td>
</tr>
<tr>
<td>other</td>
<td>12%</td>
<td>13%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>alcoholism</td>
<td>5%</td>
<td>6%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>personality disorders†</td>
<td>5%</td>
<td>7%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>other††</td>
<td>11.5%</td>
<td>13%</td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>nil psychiatric‡‡‡</td>
<td>5.5%</td>
<td>4%</td>
<td>5%</td>
<td>8%</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

* includes paranoid states  
** includes organic psychoses  
† includes sexual deviation and transient situational disorders  
‡‡‡ includes psychophysiological disorders, special symptoms, childhood disorders and ageing  
‡‡‡‡ includes not known and not applicable
Reported Psychiatric Morbidity. – Currently data are only available for the years 1963 through 1971 from the North East Scottish Psychiatric Case Register. Examination of Table I reveals that the total number of psychiatric patients has increased from 162 in 1963 to 219 in 1971 with a peak of 232 in 1968. One-year prevalence rates parallel these figures with a rise from 9.3/1000 in 1963 to 13.4/1000 in 1968 and then a drop to 12.6 in 1971. On the average 1.2 percent of the total Shetland population were in psychiatric treatment during the years 1963–1971. This is lower than the 2 percent that Mazer (1976:123) reports in his study of psychiatric disorders on the island of Martha’s Vineyard. The fact that Martha’s Vineyard had a year-round mental health clinic probably accounts for this difference. It is true in Shetland, as elsewhere, that women tend to utilize psychiatric services more than men.

The varieties of psychiatric disorders are evident in Table II. The percentage of psychotic disorders has decreased from 35 percent in 1963 to 25 percent in 1971. The main decrease in the psychoses has been from the group of affective psychoses. There has been little fluctuation in the overall percent of neurotic cases, but this is a function of an increase in depressive neuroses coupled with a decrease in other neuroses. Alcoholism and the personality disorders remained relatively steady.

The proportions of men and women in the prevalence data are very similar to those found in the incidence data (Tables III and IV). Register data in Table III reveals that for entire Shetland population, the number of new cases per year decreased from 71 (38 males and 33 females) in 1963 to 36 (14 males and 22 females) in 1971. There was no significant difference in the total number of first referrals for males as compared to females for the 9 years 1963–1971. Among

<table>
<thead>
<tr>
<th>years</th>
<th>males</th>
<th>females</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>35</td>
<td>36</td>
<td>71</td>
</tr>
<tr>
<td>1964</td>
<td>29</td>
<td>37</td>
<td>66</td>
</tr>
<tr>
<td>1965</td>
<td>34</td>
<td>28</td>
<td>62</td>
</tr>
<tr>
<td>1966</td>
<td>31</td>
<td>34</td>
<td>65</td>
</tr>
<tr>
<td>1967</td>
<td>27</td>
<td>35</td>
<td>62</td>
</tr>
<tr>
<td>1968</td>
<td>38</td>
<td>33</td>
<td>71</td>
</tr>
<tr>
<td>1969</td>
<td>25</td>
<td>29</td>
<td>54</td>
</tr>
<tr>
<td>1970</td>
<td>12</td>
<td>26</td>
<td>38</td>
</tr>
<tr>
<td>1971</td>
<td>14</td>
<td>22</td>
<td>36</td>
</tr>
<tr>
<td>total</td>
<td>245</td>
<td>280</td>
<td>525</td>
</tr>
</tbody>
</table>
TABLE IV
Percentage of new cases by diagnosis and sex
for the period 1963 through 1971

<table>
<thead>
<tr>
<th>diagnosis</th>
<th>males (N = 245)</th>
<th>females (N = 280)</th>
</tr>
</thead>
<tbody>
<tr>
<td>psychoses</td>
<td>13%</td>
<td>18%</td>
</tr>
<tr>
<td>schizophrenia*</td>
<td>7%</td>
<td>3%</td>
</tr>
<tr>
<td>affective</td>
<td>5%</td>
<td>11%</td>
</tr>
<tr>
<td>other**</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>neuroses</td>
<td>38%</td>
<td>57%</td>
</tr>
<tr>
<td>depressive</td>
<td>27%</td>
<td>46%</td>
</tr>
<tr>
<td>other</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>alcoholism</td>
<td>13%</td>
<td>1%</td>
</tr>
<tr>
<td>personality disorders†</td>
<td>9%</td>
<td>5%</td>
</tr>
<tr>
<td>other††</td>
<td>25%</td>
<td>18%</td>
</tr>
<tr>
<td>nil psychiatric†††</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

*includes paranoid states
**includes organic psychoses
†includes sexual deviation and transient situational disorders
†† includes psychophysiological disorders, special symptoms, childhood disorders and ageing
††† includes not known and not applicable

the new cases of men, more than half (57%) were single and 29 percent were married. For women, the opposite was true, 46 percent were married and only 35 percent were single. A significant sex difference was noted for referrals of widowed men and women, with almost four times as many widowed women as men being referred for treatment (11 percent women and 3 percent men). This is partially related to age, because women in Shetland outlive males. Table IV presents a listing of the diagnostic categories by percentage of new cases (male and female) referred for psychiatric treatment during the 1963–1971 period. Neurotic depression was the most common form of mental disorder among the new cases for both males (27%) and females (46%). Alcoholism was 13 times more frequent among males than females. Affective psychosis was twice as frequent in males than females. There were no diagnoses of drug dependence made during the study period.

Suicide. – There were 14 suicides (ten males and four females) in the period 1963 through 1973, or a mean of 1.27 suicides per year. It is noteworthy that all
TABLE V
Shetland crime statistics*

<table>
<thead>
<tr>
<th>Year</th>
<th>police personnel</th>
<th>class I against person</th>
<th>class II against property w/violence</th>
<th>class III against property w/o violence</th>
<th>class IV malicious injury to property</th>
<th>misc. offences</th>
<th>total crimes or offences</th>
<th>total juvenile offenders</th>
<th>drunk driving</th>
<th>road accidents fatal or non-fatal</th>
<th>aliens registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>17</td>
<td>9</td>
<td>11</td>
<td>64</td>
<td>1</td>
<td>339</td>
<td>426</td>
<td>14</td>
<td>6</td>
<td>2/56</td>
<td>2</td>
</tr>
<tr>
<td>1964</td>
<td>19</td>
<td>9</td>
<td>11</td>
<td>52</td>
<td>1</td>
<td>345</td>
<td>420</td>
<td>13</td>
<td>2</td>
<td>2/57</td>
<td>2</td>
</tr>
<tr>
<td>1965</td>
<td>20</td>
<td>16</td>
<td>19</td>
<td>53</td>
<td>2</td>
<td>350</td>
<td>440</td>
<td>10</td>
<td>2</td>
<td>1/63</td>
<td>3</td>
</tr>
<tr>
<td>1966</td>
<td>20</td>
<td>10</td>
<td>12</td>
<td>50</td>
<td>1</td>
<td>371</td>
<td>449</td>
<td>6</td>
<td>6</td>
<td>1/86</td>
<td>8</td>
</tr>
<tr>
<td>1967</td>
<td>19</td>
<td>11</td>
<td>27</td>
<td>64</td>
<td>–</td>
<td>284</td>
<td>386</td>
<td>1</td>
<td>1</td>
<td>2/65</td>
<td>5</td>
</tr>
<tr>
<td>1968</td>
<td>19</td>
<td>5</td>
<td>23</td>
<td>70</td>
<td>3</td>
<td>312</td>
<td>413</td>
<td>6</td>
<td>6</td>
<td>0/62</td>
<td>7</td>
</tr>
<tr>
<td>1969</td>
<td>19</td>
<td>4</td>
<td>15</td>
<td>33</td>
<td>3</td>
<td>266</td>
<td>321</td>
<td>8</td>
<td>7</td>
<td>0/90</td>
<td>6</td>
</tr>
<tr>
<td>1970</td>
<td>21</td>
<td>22</td>
<td>18</td>
<td>94</td>
<td>2</td>
<td>316</td>
<td>453</td>
<td>3</td>
<td>8</td>
<td>4/95</td>
<td>6</td>
</tr>
<tr>
<td>1971</td>
<td>22</td>
<td>13</td>
<td>23</td>
<td>81</td>
<td>6</td>
<td>306</td>
<td>430</td>
<td>20</td>
<td>16</td>
<td>1/91</td>
<td>7</td>
</tr>
<tr>
<td>1972</td>
<td>24</td>
<td>17</td>
<td>25</td>
<td>97</td>
<td>3</td>
<td>432</td>
<td>578</td>
<td>23</td>
<td>16</td>
<td>2/117</td>
<td>6</td>
</tr>
<tr>
<td>1973</td>
<td>23</td>
<td>15</td>
<td>22</td>
<td>96</td>
<td>4</td>
<td>644</td>
<td>788</td>
<td>23</td>
<td>58</td>
<td>1/104</td>
<td>11</td>
</tr>
<tr>
<td>1974</td>
<td>27</td>
<td>13</td>
<td>28</td>
<td>206</td>
<td>13</td>
<td>1,030</td>
<td>1,303</td>
<td>65</td>
<td>67</td>
<td>2/105</td>
<td>20</td>
</tr>
<tr>
<td>1975</td>
<td>–</td>
<td>17</td>
<td>45</td>
<td>196</td>
<td>3</td>
<td>1,174</td>
<td>1,444</td>
<td>49</td>
<td>52</td>
<td>0/72</td>
<td>146</td>
</tr>
</tbody>
</table>

†Breath testing for alcohol started in compliance with the Road Safety Act 1967.
of the female suicides occurred in the years 1970 through 1973. The overall suicide rate equals 7.5/100,000 which is lower than the rates for Scotland [9/100,000] and for England and Wales [11.5/100,000] (Kreitman 1972).

**Divorce.** — The number of divorced people in the Shetland population increased steadily from 1951 through 1971. In the 20-year period, 1951—1971, the small percentage of divorces in the population more than doubled rising from 0.17 percent in 1951 to 0.43 percent in 1971. The percent of divorced people in Shetland is lower than that of Scotland as a whole for the same period, with 0.30 percent of the Scottish population divorced in 1951 and 0.70 percent in 1971 (Census 1961, 1966, 1971).

**Crime.** — Through 1975 there has been no homicide in Shetland for more than a century, and serious crimes had been absent from the Shetland society for the same period.

Table V summarizes the crime reports for 1963 through 1975 and shows a trend of increase in most forms of crime through 1973 and a marked jump in 1974 and 1975. The number of people detained in the Lerwick jail has increased from 61 in 1970 to 128 in 1973 and 313 in 1975. It also must be noted that during this 13 year period the number of law enforcement personnel also increased from 17 in 1963 to 24 in 1972 and 27 in 1974. However, the increase in crimes was proportionally higher than the increase in law enforcement personnel.

It is noteworthy that the dramatic rise in miscellaneous crimes and crimes against property parallels the period of the oil developments in Shetland. The number of aliens (mostly male construction workers) registered in Shetland also increased from 2 in 1963 to 146 in 1975 when the oil related work was underway.

**The Individual Survey**

Generally, the preliminary results from the Individual Survey confirmed our assumption that during the baseline period both the target and control populations would not differ significantly on most of the major variables tested. The general demographic make-up was similar for both populations, with no appreciable differences in age and sex. There were few differences in the sociological profile of the two populations. The control population reflected ties to the more traditional Shetland way of life in that 50.9 percent were still involved in crofting (small, subsistence level family farms) compared to only 33.3 percent of the target population and 10 percent more control individuals (13.4% versus 3.4% in the target area) had the lowest monthly family income of
£50 ($100) or less. However, the control region had fewer native Shetlanders (81% versus 88.6% in the target area) and more people with education beyond secondary school (36.5% versus 22.2% in the target area).

There was no statistically significant difference between the target and control population report of medical and psychiatric disorders except for those listed in Table VI. There was no statistically significant difference between reports of symptoms in the target and control populations except for the symptom ‘feeling tired and rundown’. Here, the difference between the target population (27.7%) and the control population (36.8%) was significant ($p = 0.01$). The reports of the use of psychoactive and analgesic medication did not differ appreciably except for the use of tranquilizers; 6.7 percent of the control population reported taking tranquilizers compared with 3.8 percent of the target population, and again this was statistically significant ($p = 0.01$).

**Psychiatric Disturbances.** – Of the entire population, 64.3 percent indicated on the General Health Questionnaire that they were experiencing no psychiatric symptoms. This accounts for the overall low mean GHQ symptom score of 2 ($\bar{x} = 1.9$ target and $\bar{x} = 2.07$ control). Women in both populations had higher mean scores than men ($\bar{x} = 2.7$ for women, versus $\bar{x} = 1.3$ for men). Non-Shetlanders had higher mean GHQ scores than Shetlanders, in general, and when controlled for residence (target versus control) and sex. Further demographic analysis reveals that the mean GHQ scores were higher for divorced ($\bar{x} = 3$) and widowed ($\bar{x} = 3.6$) than for the married ($\bar{x} = 2.2$) single ($\bar{x} = 1.9$) or separated ($\bar{x} = 0.5$).

Our study corroborates the findings of most psychiatric epidemiological studies (B. P. Dohrenwend and B. S. Dohrenwend 1974a and b) that higher rates
TABLE VII
Mean GHQ score by social class of entire (target and control) population

<table>
<thead>
<tr>
<th>social class</th>
<th>mean GHQ score</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Profession</td>
<td>4.00</td>
<td>2</td>
</tr>
<tr>
<td>II Skilled</td>
<td>1.95</td>
<td>150</td>
</tr>
<tr>
<td>III Intermediate</td>
<td>1.40</td>
<td>250</td>
</tr>
<tr>
<td>IV Semi-skilled</td>
<td>2.73</td>
<td>66</td>
</tr>
<tr>
<td>V Unskilled</td>
<td>1.50</td>
<td>4</td>
</tr>
<tr>
<td>**VI Unemployed, Retired,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>5.04</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>2.96</td>
<td>24</td>
</tr>
<tr>
<td>Entire population</td>
<td>1.99</td>
<td>521 *</td>
</tr>
</tbody>
</table>

*521 represents the number of subjects out of the 533 total who completed the entire GHQ.
**We use the British system of assigning social class, which groups the unemployed, retired and students together; however, in our analysis we separated the students from the unemployed and retired.

of mental disturbance are associated with the lowest social class. As Table VII shows, Shetland subjects in the lowest social class have the highest mean GHQ score. However, this is not an inverse relationship because those in the highest social class do not have the lowest mean GHQ scores. In addition, people with educations at the college and university level as a group have a higher mean score on the GHQ (\( \bar{x} = 2.81 \)). However, those with less than a college education make up 88% of the target and control population. Thus, while those in the lowest extreme of the socioeconomic spectrum indicate the highest psychiatric symptom level, individuals in the upper extreme also reflect relatively high symptom levels.

From clinical studies during the development of the GHQ, it was determined that an individual who checked 12 or more symptoms could be considered a possible psychiatric case (Goldberg 1972). Table VIII presents the prevalence of such GHQ ‘cases’ as well as the prevalence of ‘depression’ and ‘trouble with nerves’ found in the illness and symptom section of the interview. The percent of GHQ cases in the target area was 4.6 percent and in the control it was 3.4 percent this difference in percent of cases in the two areas is not statistically significant at the \( p = 0.05 \) level. When we examined other self-reports of treated psychiatric symptoms from our interview, such as: ‘feeling depressed’ or having ‘trouble with your nerves’, the psychiatric symptom level increased slightly. This increase can generally be attributed to the longer time period which the subject could report having had a symptom or illness.

Although direct comparison of these prevalence rates with those of other
TABLE VIII
Prevalence of psychiatric symptoms and disorder in the target and control populations

<table>
<thead>
<tr>
<th>General Health Questionnaire</th>
<th>target</th>
<th>control</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 or more symptoms (past month)</td>
<td>12 (4.6%)</td>
<td>9 (3.4%)</td>
<td>21 (4.0%)</td>
</tr>
<tr>
<td>depression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>symptom (past year) total</td>
<td>54 (20.5%)</td>
<td>51 (18.9%)</td>
<td>105 (19.7%)</td>
</tr>
<tr>
<td>symptom (past year) treatment</td>
<td>11 (4.2%)</td>
<td>16 (5.9%)</td>
<td>27 (5.1%)</td>
</tr>
<tr>
<td>trouble with nerves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>symptom (past year) total</td>
<td>21 (8.0%)</td>
<td>27 (10.0%)</td>
<td>48 (9.0%)</td>
</tr>
<tr>
<td>symptom (past year) treatment</td>
<td>10 (3.8%)</td>
<td>19 (7.0%)</td>
<td>29 (5.4%)</td>
</tr>
<tr>
<td>trouble with nerves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disorder (entire life) total</td>
<td>38 (14.5%)</td>
<td>38 (14.1%)</td>
<td>76 (14.3%)</td>
</tr>
<tr>
<td>disorder (entire life) treatment</td>
<td>22 (8.4%)</td>
<td>28 (10.4%)</td>
<td>50 (9.4%)</td>
</tr>
<tr>
<td>disorder (past year) treatment</td>
<td>7 (2.7%)</td>
<td>10 (3.7%)</td>
<td>17 (3.2%)</td>
</tr>
</tbody>
</table>

studies is difficult due to methodological differences, as a general reference, it seems useful to place our Shetland results in a context of those from other community surveys. Our prevalence rates are within the low range of those found in seven general practice surveys in Great Britain where one-year prevalence rates ranged from 4 to 13 percent of the population at risk (Shepherd et al. 1960) Our results are lower than those found in a survey of a rural North Carolina Community where 10 percent of the population had some ‘psychiatric disorder’ (Cassel and Tyroler 1961). And they are significantly lower than the 31 percent ‘impaired’ found in a rural Florida county being affected by urbanization (Schwab, McGinnis and Warheit 1973), or the 37 percent ‘probable cases’ found in the Stirling County Survey (Leighton, D.C., et al. 1963).

SUMMARY

We have described the general methodology of a longitudinal, prospective epidemiological study designed to examine the impact that oil related developments will have on the mental health and social order of the Shetland islanders. Preliminary finding’s from the first survey, carried out during the early construction phase of oil’s introduction to Shetland, have been presented. These results focus on the official reports of treated psychiatric disorders, suicide, divorce and crime (the General Survey) as well as examining the prevalence of psychiatric symptoms and possible ‘cases’ in the two interviewed populations (the Individual Survey). Data from the General Survey covers the pre-oil period of 1963 to 1973, except for crime reports where data were available through
1975. The crime reports show a marked increase in total crimes during the same period the oil-related construction work began in Shetland.

Results from interviews with 533 Shetlanders indicate that during the early transition of Shetland becoming more industrialized there was no statistically significant difference in psychiatric disturbance between the target and control populations. The prevalence of possible psychiatric cases (defined as 12 or more symptoms checked on the General Health Questionnaire) was 4 percent for the entire Individual Survey population. Some variables associated with a higher mean GHQ score are: being female, not born in Shetland, coming from the lowest social class, and having academic education beyond secondary school.

The results reported here represent only a part of the findings of the Individual Survey. Other reports will examine other variables and their relationship to psychiatric symptoms and illnesses. The data from this baseline Shetland study provide information regarding the epidemiology of mental illness. However, when combined with the data from our first follow-up study, we hope to obtain a better understanding of the impact of rapid social and ecological change on mental health and social order.

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*University of California Medical Center, San Francisco*

**ACKNOWLEDGEMENTS**

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**NOTES**

1 *Industrialization*: The use of technology and science in the production of goods and “involving the use of complex technological equipment which can neither be owned nor operated by a single worker, extensive division of labor, formal industrial organization, and interdependence between the industrial organization and the wider society” (Slotkin 1960).

2 *Urbanization*: The depopulation of rural areas and an increased population density in settlements that provide a broader, more specialized range of goods and services [communication and transportation technology, energy supply and its side effects - noise, air, and water pollution] (Carlestram and Levi 1971).
3 Rapid social change is defined as "any institutional change that has taken place within a 15-year period" (Chance 1960).

4 Data on crime were obtained from the local and district police departments (Zetland Constabulary Chief Constable's (Annual) Report 1963–1968, Northern Constabulary Chief Constable's (Annual) Report 1969–1975). Suicide figures came from the Scottish Registrar General's annual reports (Annual Reports Registrar General Scotland, Part 1 – Mortality Statistics 1963–1975). Data on divorces were gathered from census reports (Census, 1961, 1966, (Special Census Report) and 1971, Scotland, County Report, Zetland 1962, 1967, 1972). Baseline data on various forms of environmental pollution were obtained for eventual possible correlation with mental and physical symptoms and illnesses. Water and noise pollution data were provided by the Shetland government's Department of Environmental Health. Air pollution data were collected from the British government's Department of Industry Warren Springs Laboratory reports (Department of Industry 1966–1975).

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Chodoff, P.

Clark, I. R.

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